U.S. DEPARTMENT OF COMMERCE
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PB-260 305

REPORT ON THE WATER QUALITY OF LOWER LAKE MICHIGAN, CALUMET RIVER, GRAND CALUMET RIVER, LITTLE CALUMET RIVER AND WOLF LAKE BY DEPARTMENT OF THE INTERIOR FOR THE PERIOD JULY 1966 THROUGH DECEMBER 1966, ILLINOIS-INDIANA

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
CHICAGO, ILLINOIS

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A water quality status report based on the work of the Calumet Area Surveillance Project of the Federal Water Pollution Control Administration is presented. The report evaluates the progress made in the Calumet area (Indiana-Illinois) as of December 31, 1966, reporting on the Grand Calumet River, Indiana Harbor Canal, Indiana Harbor, Little Calumet River, Wolf Lake, and Calumet Harbor.

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STATUS REPORT ON THE

CALUMET AREA POST ACTION SURVEILLANCE PROJECT

DEPARTMENT OF THE INTERIOR

FOR THE PERIOD

JULY THROUGH DECEMBER 1966

ILLINOIS-INDIANA

U. S. Department of the Interior
Federal Water Pollution Control Administration
Great Lakes Region, Chicago, Illinois
February 1967

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INTRODUCTION

This report presents an evaluation of the progress made toward improved water quality in the Calumet Area as of December 31, 1966. This evaluation is based on the results of the sampling programs of the Federal Water Pollution Control Administration's Calumet Area Post Action Surveillance Project. The waters reported on include the Grand Calumet River, the Indiana Harbor Canal, Indiana Harbor, the Little Calumet River, Wolf Lake and its outlet and Calumet Harbor.

The cooperation provided by the Indiana Stream Pollution Control Board, the Illinois Sanitary Water Board, the Metropolitan Sanitary District of Greater Chicago, the United States Coast Guard, U. S. Army Corps of Engineers and others in supplying valuable information and facilities is gratefully acknowledged.

BACKGROUND

Authority and Organization

A conference on pollution of the interstate waters of the Grand Calumet River, Little Calumet River, Calumet River, Wolf Lake, Lake Michigan and their tributaries, called by the Secretary of Health, Education and Welfare under the provisions of Section 8 of the Federal Water Pollution Control Act (33 USC 466 et. seq.) was held in Chicago, Illinois March 2-9, 1965.

Paragraph No. 14 of the Conclusions and Recommendations of the Conferees for this conference provided that "Surveillance will be the primary responsibility of the Indiana Stream Pollution Control Board, the Illinois Sanitary Water Board and the Metropolitan Sanitary District of Greater Chicago. The Department of Health, Education and Welfare will make available a resident technical group and visiting groups of experts which will assist the State agencies and the Metropolitan Sanitary District of Greater Chicago at such time as requested by them."

The State of Indiana, on April 6, 1965, and the State of Illinois, on April 16, 1965, requested an extensive sampling program by the Federal government to monitor the water quality in the Calumet Area. The Metropolitan Sanitary District has not formally requested a sampling program, but has requested laboratory assistance in the analysis of samples they have collected and in special studies they have conducted on chlorination of the effluent from their sewage treatment plant. The Calumet Area Surveillance Project was organized in the latter part of June 1965 to fulfill the requirements of paragraph No. 14 and the requests of the states.

On January 1, 1966 the Federal Water Pollution Control Administration was created within the Department of Health, Education and Welfare and incorporated the surveillance project.

On May 10, 1966 the Federal Water Pollution Control Administration was transferred from the Department of Health, Education and Welfare to the U. S. Department of the Interior.

Purpose and Scope

The purpose of the Calumet Area Surveillance Project is to assess the progress in the abatement of pollution in the conference area in cooperation with appropriate state and local agencies. This is being accomplished through a sampling program to monitor the water quality at various locations within the conference area and a series of electronic water quality monitors to continuously monitor the water quality at selected key points in the basin. Streamflow measurements are being made so that laboratory analyses in milligrams per liter can be converted to pounds per day. The information obtained through federal, state and local sampling programs and the information furnished by the industries to the state or other responsible agencies on the quality and quantity of their waste flows are evaluated.

Reports are prepared and presented to the Conferees and reconvened conferences on the current water quality and the progress toward abatement of the pollution.

DESCRIPTION OF AREA

The Calumet area is a flat plain located at the southern end of Lake Michigan and includes the Calumet-Little Calumet River system, the Grand Calumet-Indiana Harbor Canal system, Wolf Lake and its outlet. It includes approximately 742 sq. miles and forms a part of the continental divide between the Mississippi River Basin and the Great Lakes-St. Lawrence River Basin. Approximately 60% of the area drains to Lake Michigan and the remaining 40% drains to the Mississippi River by way of the Illinois River. Despite this fact the area is not well drained. There are large, marshy, low-lying areas which are subject to flooding during and after heavy rainfalls. The streams are sluggish and meandering except where they have been artificially maintained and/or supplemented by industrial or municipal waste flows.

The Grand Calumet and the Little Calumet Rivers both traverse the divide. On the Grand Calumet the divide is normally located at the Hammond, Indiana Sewage treatment plant outfall. Approximately two thirds of the effluent flows west into the Calumet River in Illinois and one third flows east to the Indiana Harbor Canal and Lake Michigan. Rainfall and lake level conditions can cause the divide to shift to either the east or the west.

The location of the divide on the Little Calumet River is not definite and varies over a distance of several miles in the vicinity of Highland, Indiana. The western portion flows to the Cal-Sag Channel in Illinois which connects the system to the Illinois River. The eastern portion flows to Lake Michigan by way of Burns Ditch which discharges to the lake near Ogden Dunes, Indiana.

Flow in the Calumet River is controlled by the O'Brien Lock and is directed from Lake Michigan to the Cal-Sag Channel except during periods of heavy flooding or unusually low lake levels.

The Indiana Harbor Canal which was completed in 1903 connects the Grand Calumet River to Lake Michigan. The Grand Calumet River east of the Hammond Sewage Treatment Plant outfall is tributary to Lake Michigan through the canal.

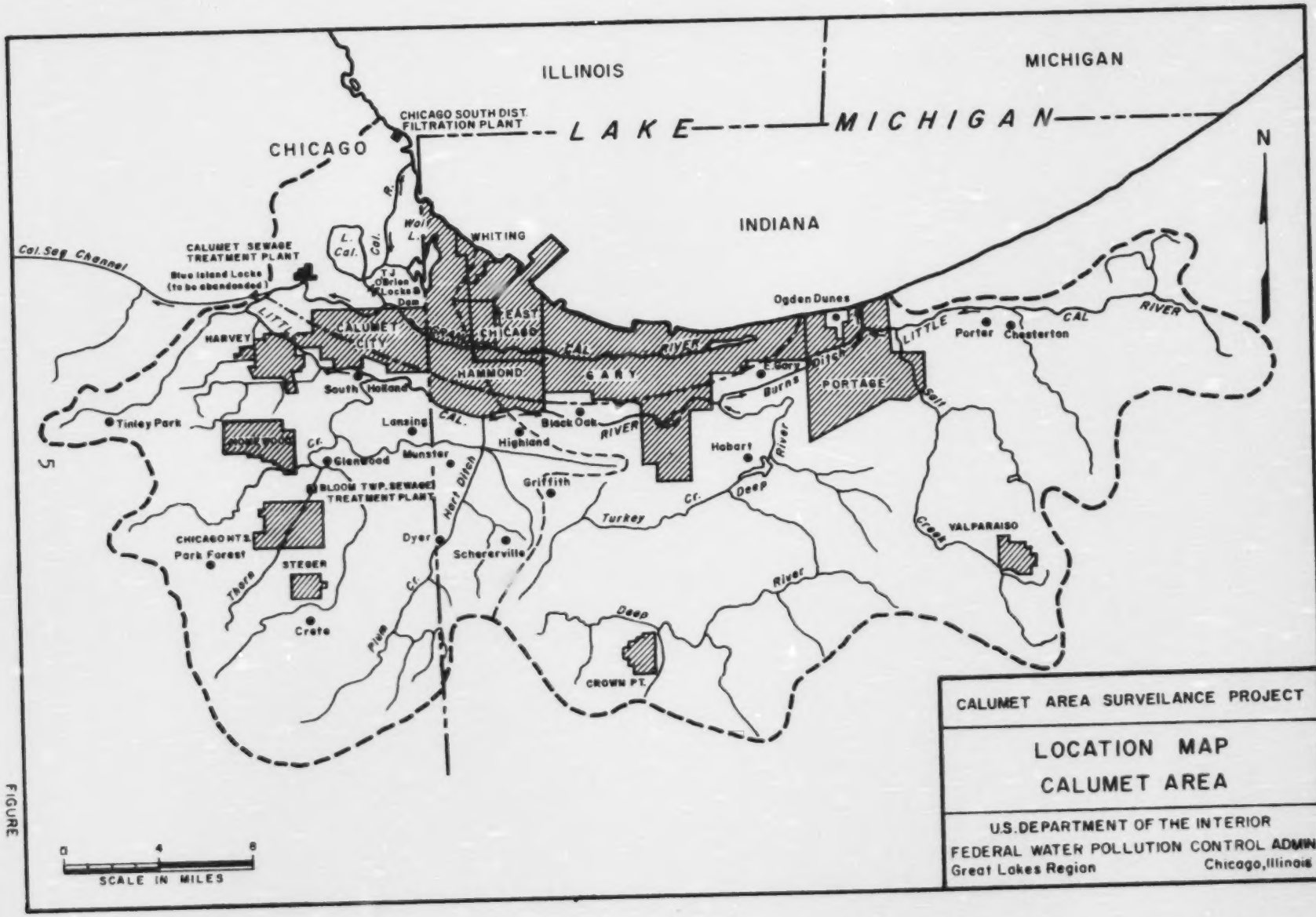
Wolf Lake is located on the Illinois-Indiana state line between Chicago, Illinois and Hammond, Indiana. The original outlet from Wolf Lake to Lake Michigan has been blocked and an outlet to the Calumet River in Chicago has been constructed. The City of Hammond maintains a park which occupies most of the Indiana shoreline of the lake. This park and the lake are extensively used for recreation. The Illinois portion of the lake is a part of the Wolf Lake Conservation Area.

Cities and Industries

The major population centers in the area are East Chicago, Gary, Hammond and Whiting, in Indiana; and Calumet City, Chicago Heights and a

part of the south side of Chicago in Illinois. The area is highly industrialized. There are ten major steel mills including the United States Steel Corporation's Gary Works, Gary Sheet and Tin Mill, Youngstown Sheet and Tube Company, and Inland Steel Company in Indiana and United States Steel's South Works, the Wisconsin Steel Company, the Interlake Iron Corporation, the Republic Steel Corporation and the Acme Steel Company in Illinois. There are five petroleum refineries including the American Oil Company, the Cities Service Petroleum Company, the Mobil Oil Company, and the Sinclair Refining Company, in Indiana and the Clark Oil and Refining Co. in Illinois. Other industries include Lever Brothers, Union Carbide Chemical, I.E. Du Pont, M. & T. Chemicals, American Maize and a large number of smaller concerns.

These industries are located in three major groups. One group is concentrated along the Calumet River in Illinois. Another is along the Indiana Harbor Canal and the third is in Gary, Indiana and discharges to the headwaters of the Grand Calumet River. These three groups make the Calumet Area one of the most important industrial centers in the nation.



CALUMET AREA SURVEILANCE PROJECT

LOCATION MAP
CALUMET AREA

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region Chicago, Illinois

FIGURE 5

DESCRIPTION OF PROGRAMS

Stream and Harbor Sampling Programs

During the period July to December 1966 seventeen stream, harbor and water intake stations were sampled on a weekly basis for chemical and microbiological quality. Thirteen of these were sampled during the entire period. The remaining four are lake stations that require a boat for sampling. These were not sampled after October 27, 1966 due to ice and inclement weather on the lake. The results of this program are the basis for this report.

Beach Sampling Program

Sampling on seven beaches in the area was initiated on May 31, 1966 and continued on a twice weekly basis until September 15, 1966. Six of these beaches are located on Lake Michigan and one on Wolf Lake. Five of the beaches were sampled at their mid-points in water approximately four feet deep. Two beaches, Rainbow Beach and Calumet Inner Beach, were sampled at two points each at the one third points. Samples were collected on Tuesday and Thursday of each week and analyzed for total coliforms, fecal coliforms and fecal streptococci. This program was coordinated with the beach sampling programs of the Chicago Park District and the Indiana State Board of Health and data was distributed freely among the agencies. The results of the beach sampling program for the 1966 season were presented in the progress report covering the period January to June 1966.

Hydraulic Measurements Program

No gaging stations are maintained by the U. S. Geological Survey in the Grand Calumet-Indiana Harbor Canal drainage system. Therefore, six continuous water level recorders have been installed on these streams. The streams are being gaged at these stations so that rating curves can be developed for each station. The stage vs discharge relationship in the Indiana Harbor Canal and eastern portion of the Grand Calumet River is seriously distorted by fluctuations in the level of Lake Michigan. Special flow area, velocity and stream slope studies are being made in order to develop flow data for these streams.

Information provided by the U. S. Geological Survey and the Metropolitan Sanitary District will be used as the basis for flow calculations on the Little Calumet River, the Calumet River and Wolf Lake Outlet.

The purpose of this program is to develop flow data for all of the sampling stations in the surveillance area except for those located in Lake Michigan.

Automatic Monitoring Program

Many operations of the industries in the basin require discharge of wastes on a batch basis, and wastes from these tanks may be dumped at any

time of the day, week, or month depending on the needs of the industry. These discharges and accidental spills of oil or other pollutants could pass into Lake Michigan or down the Illinois River unobserved by a once-a-week sampling program.

During November 1965 an automatic water quality monitoring station was installed in Indiana Harbor at the East Breakwall Inner Light. This installation continuously records the dissolved oxygen, pH, conductivity and temperature of the water flowing past this point into Lake Michigan. A complete report on this installation was given in report covering the period June through November 1965.

A second monitor was installed during August 1966 to measure the same parameters at the mouth of the Calumet River. This monitor replaces the semi-portable, temporary monitor that had been located there during 1965. A complete report on this new installation is included as an appendix to this report. It is planned to mount the semi-portable monitor in a boat and use it for profile studies of the various streams in the area. This procedure should be of value in pinpointing specific sources of wastes in the area.

An automatic sampling device will be installed on each monitor as soon as it becomes available. This device will automatically collect a sample when one or more of the parameters being monitored exceed certain limits.

This year it is planned to install two additional monitors and a central control station to which all the data will be continuously telemetered. One monitor will be located at Wentworth Avenue on the Little Calumet River and will monitor the quality of the water flowing across the state line at this point. The other will be located on the Grand Calumet River below the industrial complex at Gary, Indiana. This will monitor pollutants discharged to the headwaters of the stream and may enable warnings to be given to downstream uses of the approaching pollution. Eventually a network of six monitors is planned for the area.

Biological Surveying Program

The kinds and numbers of aquatic plants and animals inhabiting a particular body of water and the stream or lake bottom beneath it, reflect the quality of the water that prevails in the area. Some organisms are capable of withstanding polluted conditions and will multiply rapidly when competition from other less tolerant organisms is eliminated. These pollution tolerant organisms include sludgeworms, bloodworms, leaches, blue green algae and pulmonate snails. In an unpolluted environment the number of these organisms is restricted by competition from other species but when the other species are killed off by pollution they multiply rapidly. Therefore, the continuous or sudden introduction of toxic wastes, settleable solids or oxygen consuming materials alters the composition of the benthic population. A balanced population is not restored immediately upon the return of optimum water quality because of the lengths of the life cycles of those organisms which vary from weeks to years. This fact makes it possible to detect

slugs of pollution that have passed through a sampling station.

Fifteen substrate samples of the Dendy type were made and used in the waters of the Calumet area during October through November 1965 on an experimental basis. The results obtained from these samples have been compared with the more standard dredge samples that were taken at the same time. The results of this experiment are not conclusive. Further experimentation with this sampling method is planned next spring.

During July 1966 a biological survey was made of the Calumet and portions of the Little Calumet River and bottom muds were sampled in the Calumet River and the Indiana Harbor Canal to determine the quality of the material dredged from these streams. The results of these surveys are presented as a part of this report.

CONCLUSIONS

1. The water quality in the Little Calumet River at the state line has greatly improved since 1963 and progress on domestic pollution is still being made. The stream is still polluted and does not meet the recommended criteria.

2. The water quality in the Grand Calumet River at the state line improved considerably before December 1966 but deteriorated badly in December.

3. The microbiological quality of the Grand Calumet-Indiana Harbor Canal system has improved considerably since 1965 due to the sewer separation program of the industries, but industrial pollution has become more severe.

4. Wolf Lake is a clean body of water which meets most of the recommended criteria. Occasional detergent spills are the only significant pollution problem.

5. The water at intakes in the inner harbor basins meets some of the recommended criteria but is affected by wastes from Indiana Harbor.

6. The water at municipal intakes in open Lake Michigan substantially meets the recommended criteria.

7. The water of Wolf Lake, and open waters of Lake Michigan, do not meet the recommended criteria for pH or for maximum acceptable ammonia nitrogen concentration.

SPECIAL ADDENDUM

On January 17, 1967 the superintendent of the East Chicago Water Filtration Plant (Station 15) reported that his plant experienced a severe taste and odor problem on the previous weekend. He further stated that taste and odor problems have occurred on several weekends in the past. This was confirmed by the superintendent of the Hammond Water Filtration Plant who stated that he always has taste and odor problems but that they are more severe on weekends.

In order to investigate this problem special sampling runs were made on Friday, January 20, 1967, Saturday, January 21 and Sunday, January 22. The Indiana Harbor Canal was sampled at 151st St. (Sta. 2) and Dickey Road (Sta. 3). Indiana Harbor was sampled at the monitor (Sta.6) and the East Chicago and Hammond water intakes (Stations 15 and 16) were sampled for phenols and cyanides. The following tables are the results of this sampling:

Friday, January 20, 1967

Station	Water Temp.°C	Wind Direction	Cyanide mg/l	Phenol ug/l
2	10	south	0.22	135
3	9	"	0.21	183
6	14	"	0.29	216
15	0	"	0.01	3
16	0	"	none found	2

Saturday, January 21, 1967

2	10	"	0.15	161
3	10	"	0.20	192
6	9	"	0.32	138
15	1	"	none found	2
16	1	southwest	0.02	29

Sunday, January 22, 1967

2	11	calm	0.23	135
3	11	south	0.12	60
6	9	"	0.34	185
15	1	"	none found	1
16	1	"	0.02	16

It is evident that wind induced currents directed the pollution away from the East Chicago intake toward the Hammond intake. The Saturday and Sunday phenols at the Hammond intake were far higher than we had found

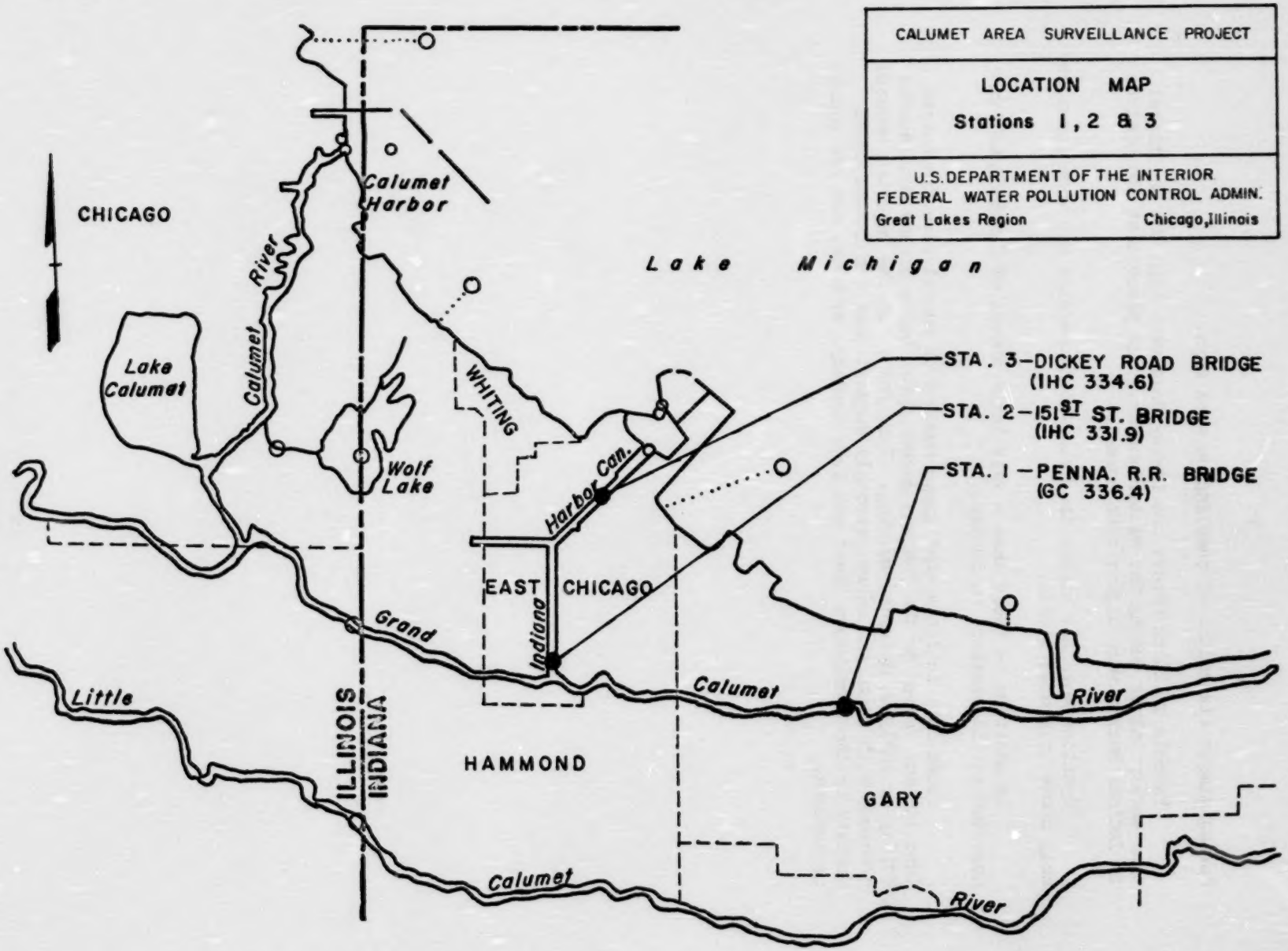
during almost six months of sampling on week days.

Phenols at 151st Street and Dickey Road were high but not higher than weekly values during the winter months. The phenols at the monitor in Indiana Harbor were higher than normal.

Cyanides were not higher than the weekly samples but were considerably above tolerable limits.

In addition to these data a very large amount of floating oil was observed at all stations on Sunday.

These data indicate that large amounts of phenol were discharged into Indiana Harbor or the Indiana Harbor Canal below Dickey Road during Friday or early on Saturday morning. This fact, and the reported weekend problems with taste and odors, strongly suggest that the Inland Steel Company or the Youngstown Sheet and Tube Company, or both, are the source or sources.


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 1, 2 & 3
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
Calumet Harbor
Lake Michigan
Calumet River
Lake Calumet
Wolf Lake
WHITING
Harbor Can.
STA. 3—DICKEY ROAD BRIDGE (IHC 334.6)
STA. 2—151ST ST. BRIDGE (IHC 331.9)
STA. 1—PENNA. R.R. BRIDGE (GC 336.4)
EAST CHICAGO
Indiana
Grand
Calumet
River
Little
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet
River

WATER QUALITY

Stream, Harbor and Water Intake Sampling

Thirteen stream and harbor stations were sampled for bacteriological and chemical quality during the last six months of 1966. Four water intakes located in Lake Michigan and designated as control points by the technical committee, have been sampled since August 3, 1966. Samples were collected once each week except that stations requiring a boat could not be sampled during severe weather. All stream stations were sampled at mid-stream except for the monitor stations, Nos. 6 and 11, which were sampled at the water quality monitor intake. The samples for bacteriological analysis were taken at a depth of 6 inches to 1 foot. The samples for chemical analysis were taken at mid-depth or 10 feet in the case of navigable channels. All water intake samples were taken from the raw water tap at the filtration plant.

All samples were immediately preserved and/or iced where required in accordance with procedures established in "Standard Methods for Examination of Water and Wastewater, 12th Edition, 1965." Laboratory analysis on samples subject to deterioration was initiated on the same day they were collected.

Bacteriological analyses were performed in accordance with "Standard Methods." Total coliform, fecal coliform and fecal streptococci counts were made on each sample. The results of these analyses are presented in bar graphs for each station. All values on these bar graphs and in the following discussion are the number of organisms per 100 ml.

Chemical analyses were performed in accordance with methods agreed upon at the Calumet Area Enforcement Laboratory Directors' Meeting held on April 29, 1965.

Station 1 - Grand Calumet River at Pennsylvania R. R. Bridge

This station is located upstream of the Gary Sewage Treatment Plant where the bulk of the flow is from the United States Steel Company's complex at Gary, Indiana, located approximately two miles upstream.

The data (Table 1) indicate that the trends reported in the January to June 1966 report have continued. Progress has been made toward abating the domestic pollution problem but the industrial waste problem is becoming more severe.

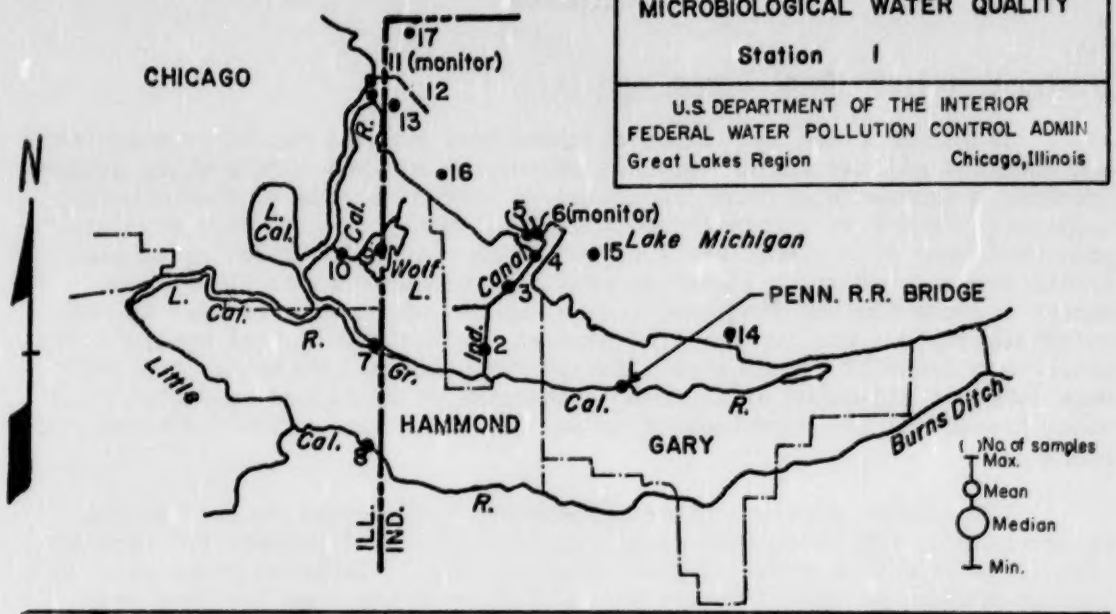
The Microbiological Water Quality graphs on page 14 indicate that the average and median coliforms were higher during the last half of 1966 than during the first half, probably because the average water temperature was 16°C during the first six months and 22.4°C during the last six months. This was also true for all of the other stations.

CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 1

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



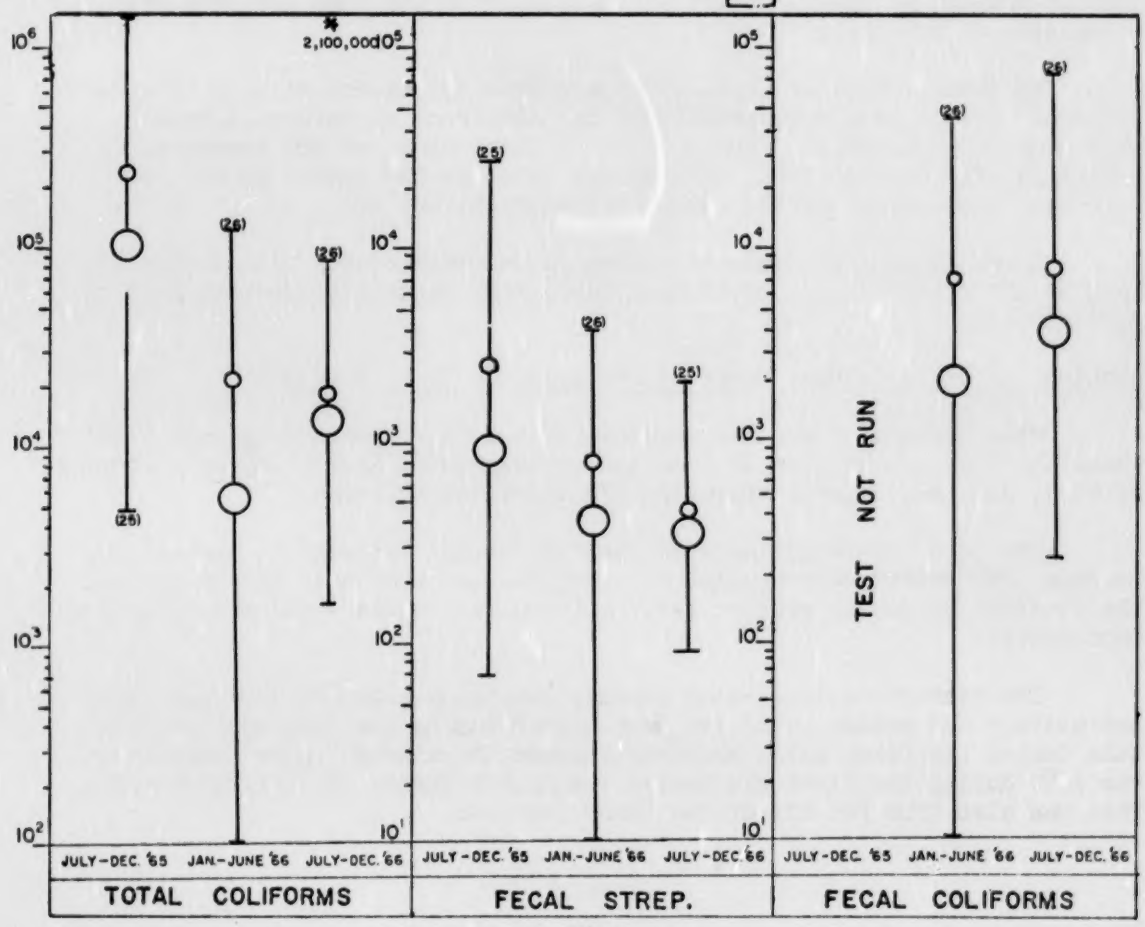


TABLE 1

CHEMICAL QUALITY OF WATER
STATION 1 - GRAND CALUMET RIVER AT PENNSYLVANIA R.R. BRIDGE-GC 336.6

Parameter		July 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	29	12	21.8	21	28	10	16	16	32	10	22.4	24
pH		7.5	4.1	-	6.9	8.0	3.6	-	6.9	7.1	6.5	-	6.8
Conductivity	umho/cm	-	-	-	-	765	308	399	380	580	345	392	375
Alkalinity	mg/l	-	-	-	-	-	-	-	-	122	80	100	101
DO	"	8.7	1.1	4.6	4.3	9.00	2.50	5.83	5.80	8.85	2.10	4.83	4.80
BOD	"	17.0	5.7	9.98	8.4	16	2.4	8.6	8.6	15	3.0	8.03	7.9
COD	"	152	7.9	42.2	31	43	21	28	27	55	14	33	33
Sulphates	"	186	32	60	52	200	37	66	56	71	39	53.8	54
Chlorides	"	-	-	-	-	40	14	20	18	27	10	14.8	17
MBAS	"	-	-	-	-	0.28	0.07	0.14	0.12	.22	.08	.136	.13
NH_3-N	"	3.70	0.87	1.53	1.45	4.4	1.5	2.4	2.4	4.20	.88	2.08	1.7
NO_2+NO_3-N	"	3.65	0.32	0.897	0.68	11.3	0.18	0.89	0.55	0.90	0.09	0.52	0.55
Org. N	"	3.71	0.06	1.48	0.65	1.2	0.0	0.40	0.40	1.1	0.1	0.5	0.4
Sol PO_4	"	0.33	0.00	0.10	0.08	0.41	0.02	0.19	0.17	0.40	0.01	0.05	0.03
Total PO_4	"	1.2	0.10	0.36	0.29	0.58	0.11	0.26	0.23	0.86	0.13	0.32	0.27
Iron	"	29.0	2.2	8.78	6.15	48	3.2	9.7	5.8	40	2.6	16.5	14
Cyanide	"	0.80	0.00	0.12	0.02	0.63	0.00	0.32	0.39	0.58	0.01	0.22	0.20
Sus. Solids	"	130	26	46.55	42	125	30	67	68	195	29	74	62
Dis. Solids	"	364	170	225.77	225	380	205	247	235	294	109	226	230
Phenol	ug/l	392	10.0	79.14	30.0	320	18	126	129	254	7.6	53.2	43
		Data based on 19 samples				Data based on 26 samples				Data based on 26 samples			

Median and average total coliform and fecal streptococci counts from July-December 1966 were approximately one tenth of their levels during the same period in 1965. This, combined with the fact that the water temperatures were slightly higher in 1966, indicates that the improvement noted in our previous report has been continued.

On July 28, 1966 there was one very high total coliform count of 2,100,000 per 100 ml. The maximum fecal coliform count also occurred on that date. The high counts must have resulted from an accidental spill or overflow to the stream because they do not represent the general quality of the stream.

Although an improvement has been made, the microbiological pollution of the stream is still too great to meet any reasonable criteria that may be established for the stream.

Data in Table 1 "Chemical Quality of Water" clearly indicate the increased levels of industrial waste pollution. The rise in water temperature since 1965 is attributable to the use of more cooling water. Other water quality indices affected by wastes from steel mills show considerable increases. Total iron increased from an average of 8.78 mg/l in 1965 to 16.5 mg/l in 1966. Cyanides rose from 0.12 mg/l to 0.22 mg/l and the median phenol value rose from 30.0 ug/l to 43 ug/l. It should be noted in the July-December 1965 data the mean phenol value was affected by one unusually high value. Suspended and dissolved solids also increased. Oil has been reported on the surface at every sampling.

Sulphates, which is an indicator of spent pickle liquor, did not increase. This may be the result of the deep well injection system that has been built by the steel companies for the disposal of this waste. No large slugs of spent pickling liquor such as the one reported on June 3, 1966 were detected during the last half of 1966.

Station 2 - Indiana Harbor Canal at 151st St.

This station was established in order to determine the quality of the water in the canal where it is formed by the two portions of the Grand Calumet River. The stream at this point is affected by effluent from the Gary, Hammond and East Chicago sewage treatment plants as well as effluents from a number of industries on the Grand Calumet River. The Gary and East Chicago sewage treatment plants are chlorinating their effluent at present.

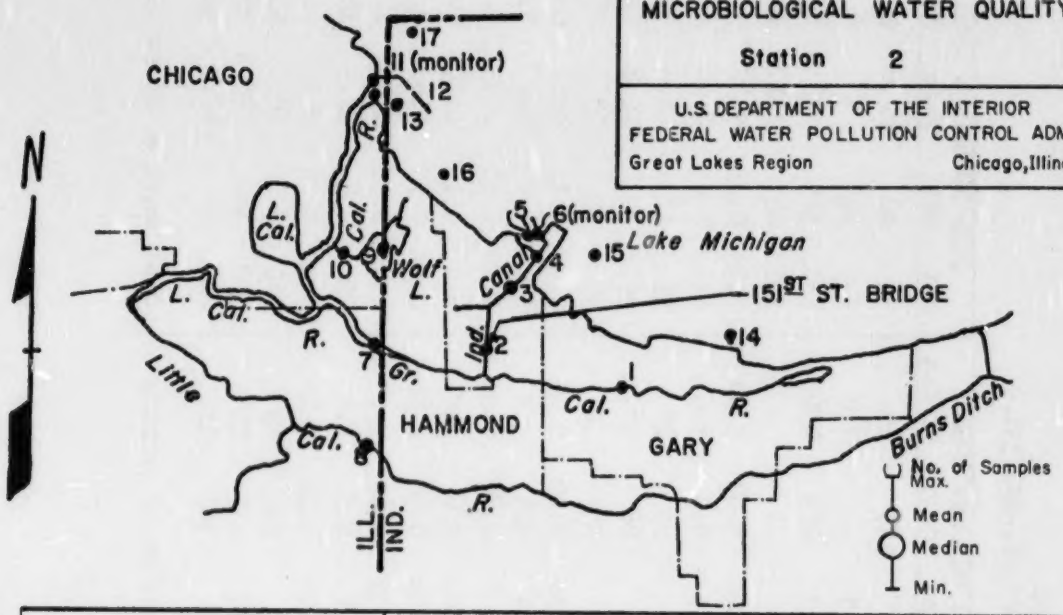
The trends noted in the report on January-June 1966 and at Station 1 continue to be evident at this station. A comparison of the microbiological bar graphs for Stations 1 and 2 shows that the patterns are the same but the level of pollution is higher. Once again the increase over the first half of 1966 is attributed to the temperature differential and a considerable improvement in quality over January-June 1965 is evident. The higher

CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 2

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



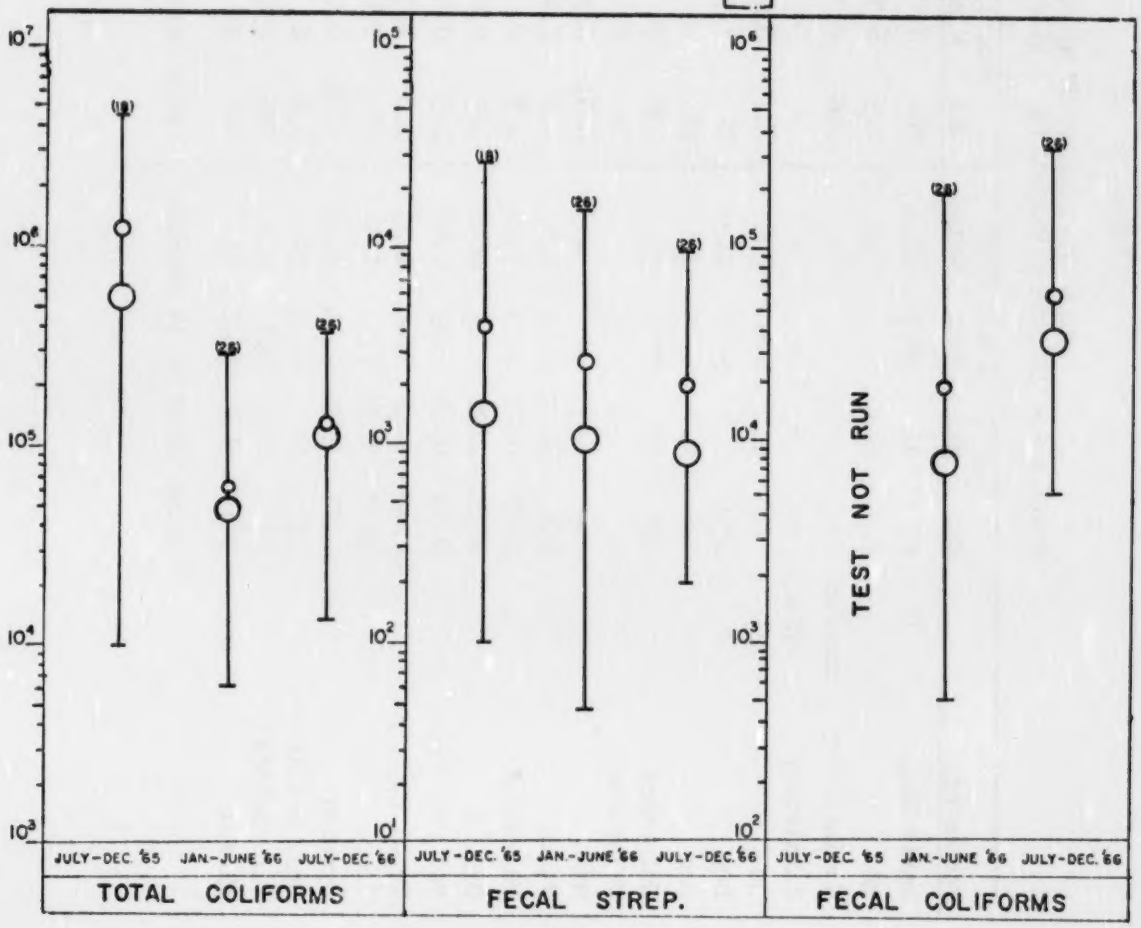


TABLE 2

CHEMICAL QUALITY OF WATER
STATION 2 - INDIANA HARBOR CANAL - 151ST ST.-IHC 331.9

Parameter		July 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	27	11	18.3	18.5	26	5	15	15	31	10	22.0	22.0
pH		7.3	6.3	-	7.0	7.9	6.5	-	7.0	7.2	6.3	-	6.9
Conductivity	umho/cm	-	-	-	-	530	430	473	480	550	385	456	450
Alkalinity	mg/l	-	-	-	-	-	-	-	-	156	84	111.7	105
DO	"	7.7	2.1	4.4	4.6	8.1	0.20	5.07	5.60	7.15	0.85	3.69	3.65
BOD	"	13.0	4.4	9.0	11.0	22	4.9	8.9	7.6	14	5.2	8.94	8.7
COD	"	148	7.7	41.7	39.5	60	18	29	28	59	17	34.6	33
Sulphates	"	128	50	70	66	138	74	88	87	99	50	72.8	73
Chlorides	"	-	-	-	-	70	29	36	32	40	16	25	25
MBAS	"	-	-	-	-	0.61	0.16	0.29	0.29	0.30	0.13	0.21	0.22
NH_3-N	"	4.0	0.77	2.45	2.8	4.7	2.4	3.4	3.3	5.1	1.6	3.6	3.1
NO_2+NO_3-N	"	2.20	0.23	1.13	1.10	1.5	0.21	0.80	0.80	1.70	0.08	0.73	0.65
Org. N	"	4.30	0.30	1.17	0.90	1.3	0.00	0.6	0.7	5.0	0.1	0.87	0.6
Sol PO_4	"	0.84	0.11	0.49	0.46	1.32	0.19	0.58	0.50	0.81	0.10	0.42	0.40
Total PO_4	"	4.60	0.52	1.26	1.15	2.0	0.32	0.82	0.75	2.8	0.56	1.44	1.3
Iron	"	15.0	0.78	4.55	1.50	17	1.8	5.5	4.4	29	2.8	12.3	12
Cyanide	"	0.53	0.00	0.11	0.20	0.44	0.00	0.19	0.16	0.20	0.04	0.10	0.09
Sus. Solids	"	136	10	41.3	34	110	23	61	59	162	7	60.8	55
Dis. Solids	"	640	240	297	270	375	250	295	295	300	160	256.8	260
Phenol	ug/l	308.0	9.0	71.2	25	228	23	107	111	263	15	47.0	32
		Data based on 15 samples				Data based on 26 samples				Data based on 26 samples			

level of microbiological pollution is due to the sewage treatment plants that affect Station 2.

The pattern of increasing industrial pollution is also the same with one exception. Cyanides originating upstream of Station 1 would be expected to degrade considerably before reaching Station 2. This was not the case in 1965. It is likely that there was a source of cyanide between the two stations. In 1966, however, the cyanides at Station 2 were considerably lower than at Station 1 which may indicate that cyanide from that source has been abated.

Samples from this station were composited on a monthly basis and analyzed for heavy metals. The following are average values for the last six months of 1966:

Cadmium	less than 0.005	mg/l
Copper	0.07	"
Chromium	0.07	"
Potassium	4.6	"
Manganese	0.27	"
Lead	0.14	"
Nickel	0.03	"
Arsenic	less than 0.001	"
Zinc	1.17	"
Sodium	18	"

Station 3 - Indiana Harbor Canal at Dickey Road

This station is located two and a half miles downstream from 151st St. (Station 2) and is the last highway bridge across the canal before it discharges into Indiana Harbor.

The trends in water quality noted at the two upstream stations also occurred at this station. The bacterial counts were lower in 1966, the dissolved oxygen higher and industrial pollution more evident.

The decline in sewage pollution reported in the January-June 1966 report is confirmed by the July-December data. DO increased despite the fact that the median temperature increased from 21.5°C to 25°C. The graph "Microbiological Water Quality-Station 3" on page 20 reveals lower coliform counts in 1966 but this reduction is not as sharp as the reduction at the two upstream stations.

Although some improvement has been made, DO was often zero during July, August and September 1966 and gassing was noted on several occasions.

CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 3

U.S. DEPARTMENT OF THE INTERIOR
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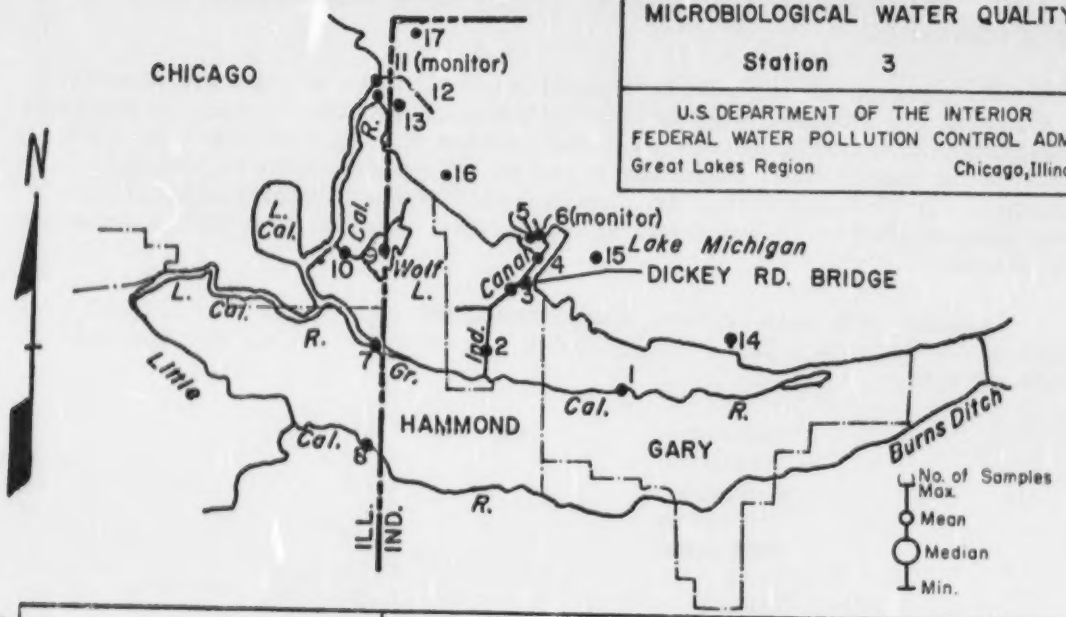
Great Lakes Region Chicago, Illinois



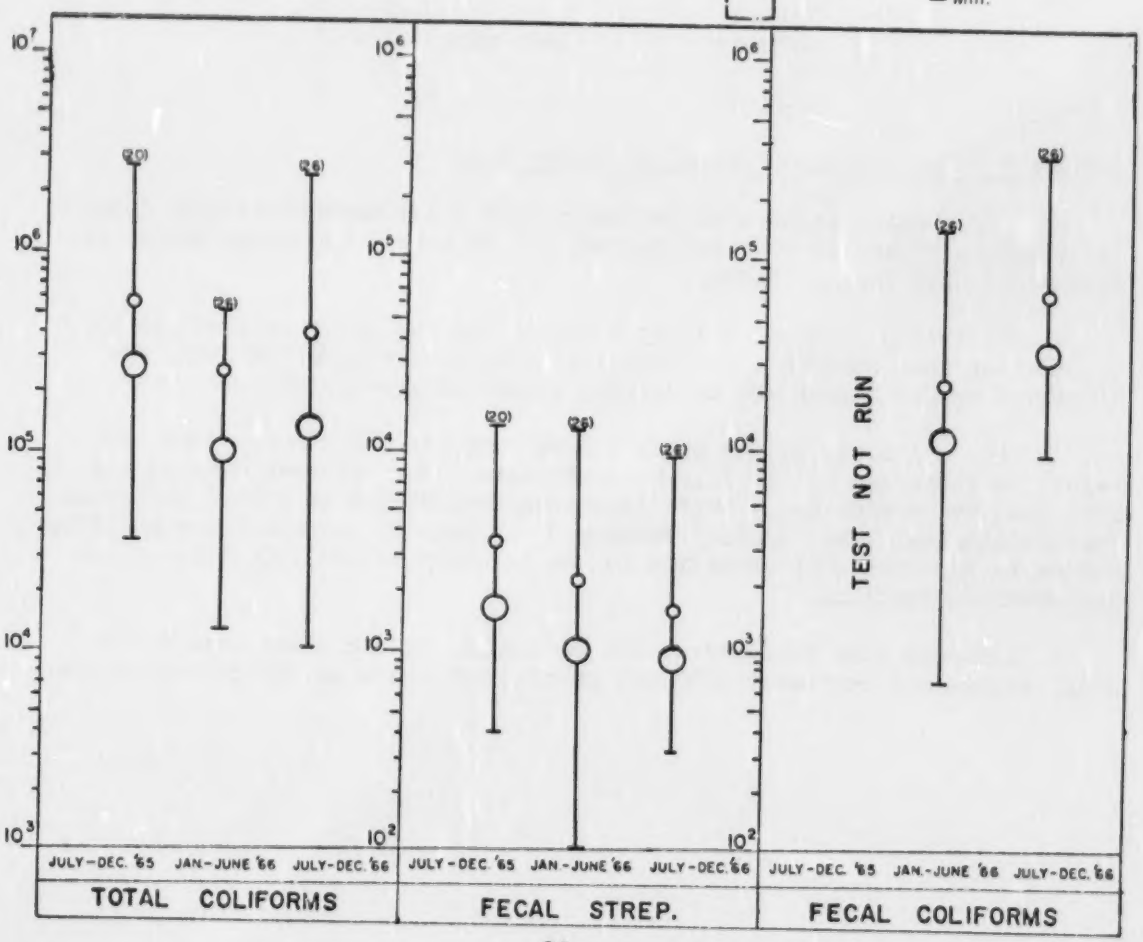


TABLE 3

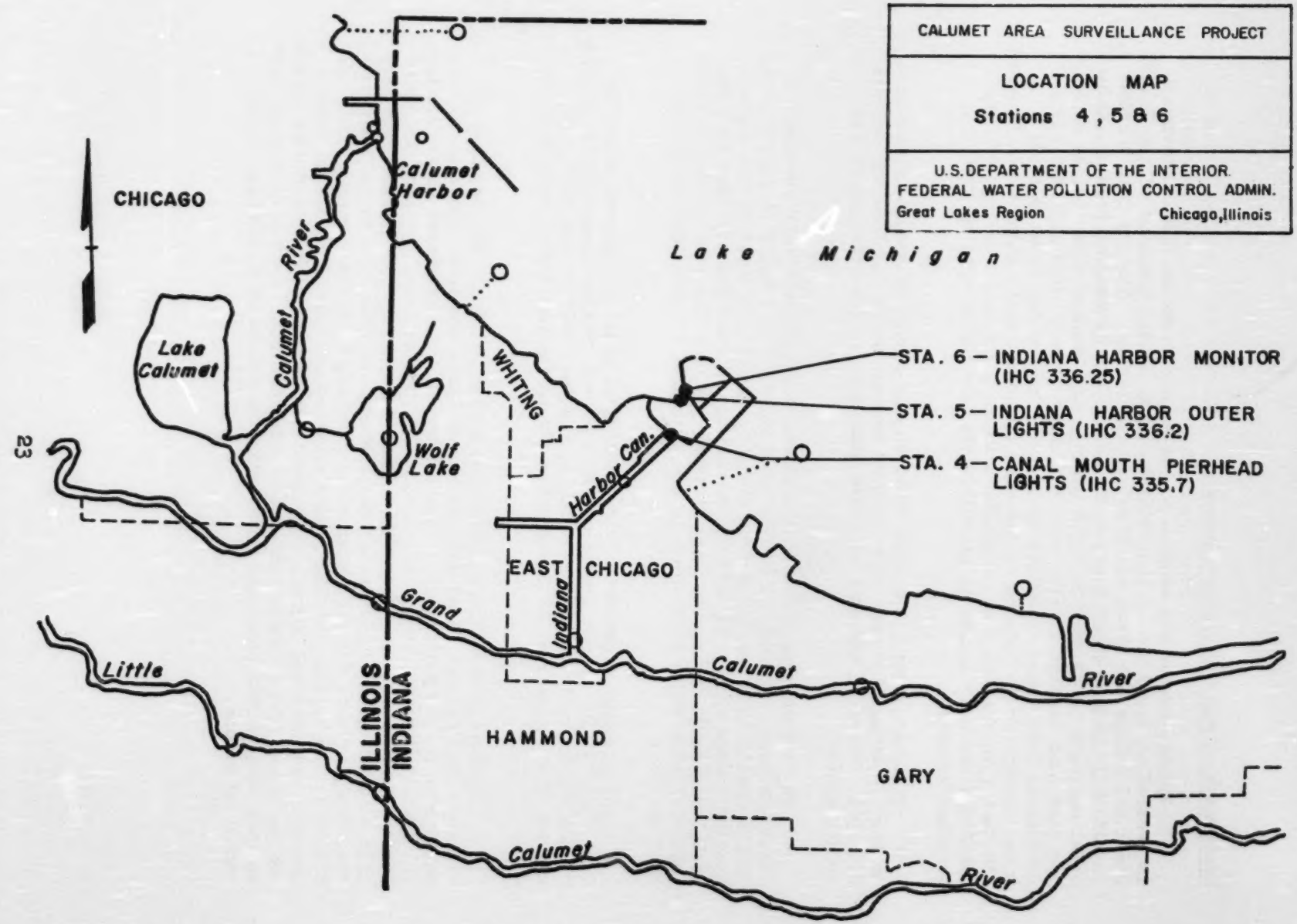
CHEMICAL QUALITY OF WATER
STATION 3 - INDIANA HARBOR CANAL AT DICKEY ROAD-IHC 334.6

Parameter		July 1965-Dec. 1965 Max	Min	Mean	Median	Jan. 1966-June 1966 Max	Min	Mean	Median	July 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	29	11	20	21.5	27	9	15	14	31	8	21.1	25
pH		7.3	6.3	-	7.0	8.0	6.4	-	7.0	7.1	6.7	--	6.9
Conductivity	umho/cm	-	-	-	-	615	400	501	505	800	410	495	470
Alkalinity	mg/l	-	-	-	-	-	-	-	-	122	65	104	111
DO	"	6.40	0.00	1.82	0.25	6.70	0.00	3.10	4.10	7.20	0.00	2.04	1.55
BOD	"	11.0	3.5	6.25	5.7	9.0	2.2	5.1	5.3	18	2.5	5.9	5.0
COD	"	147.00	0.00	33.95	27.3	33	12	22	22	47	15	24.6	24
Sulphates	"	96.00	45.60	70.64	74	122	59	80	78	100	61	75	81
Chlorides	"	-	-	-	-	44	22	29	29	47	22	30.6	30
MBAS	"	-	-	-	-	0.35	0.17	0.24	0.24	0.55	0.17	0.34	0.30
NH_3-N	"	3.40	1.10	2.48	2.65	6.7	2.6	3.7	3.6	5.8	1.5	3.4	3.2
NO_2+NO_3-N	"	3.50	0.31	1.15	1.05	2.8	0.15	0.84	0.75	2.40	0.20	0.71	0.65
Org. N	"	5.40	0.08	1.68	1.05	2.4	0.3	0.7	0.6	4.5	0.2	0.9	0.7
Sol PO_4	"	0.86	0.04	0.29	0.285	0.54	0.11	0.32	0.29	0.50	0.08	0.22	0.22
Total PO_4	"	1.10	0.24	0.59	0.55	0.73	0.26	0.47	0.46	1.3	0.05	.75	0.73
Iron	"	4.90	0.88	2.35	2.05	9.0	0.99	3.16	2.3	7.7	1.6	3.1	2.9
Cyanide	"	0.29	0.00	0.03	0.00	0.56	0.00	0.13	0.13	0.27	0.01	0.07	0.04
Sus. Solids	"	41.0	6.5	15.94	15.0	84	6	25	19	64	4	23	21
Dis. Solids	"	360.0	240.0	291.4	290	385	220	314	310	336	141	272.7	280
Phenol	ug/l	232.0	1.2	39.0	20.0	483	16	102	61	235	10	35	24
		Data based on 26 samples				Data based on 26 samples				Data based on 26 samples			

The industrial waste parameters follow the pattern established at the upstream stations; significantly higher total iron, cyanide, suspended solids and phenols. The sulphates also increased from a median of 74 in July-December 1965 to a median of 81 in July-December 1966.

Samples for this station were composited on a monthly basis and analyzed for heavy metals. The following are average values for the last six months of 1966:

Cadmium	less than	0.005	mg/l
Copper		0.08	"
Chromium		0.04	"
Potassium		4.5	"
Manganese		0.22	"
Lead		0.06	"
Nickel		0.03	"
Arsenic	less than	0.001	"
Zinc		0.63	"
Sodium		21	"


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 4, 5 & 6
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
Calumet Harbor
Calumet River
Lake Michigan
Lake Calumet
Wolf Lake
WHITING
Harbor Can.
STA. 6 — INDIANA HARBOR MONITOR (IHC 336.25)
STA. 5 — INDIANA HARBOR OUTER LIGHTS (IHC 336.2)
STA. 4 — CANAL MOUTH PIERHEAD LIGHTS (IHC 335.7)
EAST CHICAGO
Indiana
Grand
Little
Calumet River
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet River

Stations 4, 5 and 6 - Indiana Harbor

Indiana Harbor was sampled at three points during 1966. Station 4 is located at the mouth of the Indiana Harbor Canal, upstream of the Inland Steel and Youngstown Sheet and Tube turning basins. Station 5 is located immediately downstream of the turning basins and downstream from all industrial outfalls to the harbor. The average dry weather flow to Lake Michigan past this station is 2700 cfs, but under certain wind and lake level conditions lake water is backed up into the harbor for short periods of time. Station 6 is located at the east breakwall inner light which is about 150 feet from Station 5 and contains a water quality monitoring station. Station 6 was established to correlate the monitoring program with the sampling program.

Stations 4 and 5 are boat stations and cannot be sampled in rough weather. During 1966 they were sampled between March 31, 1966 and October 27, 1966, therefore the data at these stations is less affected by the colder months.

The trends observed at the upstream stations were also apparent at these stations. At Station 4, the coliform counts, graphed on page 25, were higher during the last six months of 1966, probably because of the higher average temperature. The average temperature during January-June 1966 was 18°C, and 24.5°C during the July-December period. The counts for all three bacterial parameters were lower in the last half of 1966 than in the last half of 1965.

At Stations 5 and 6 the microbiological quality improved since the first half of 1966. The graphs on pages 26 and 27 show lower counts in spite of the higher water temperatures during the last half of the year. It appears that discharges of sewage directly to Indiana Harbor have been reduced.

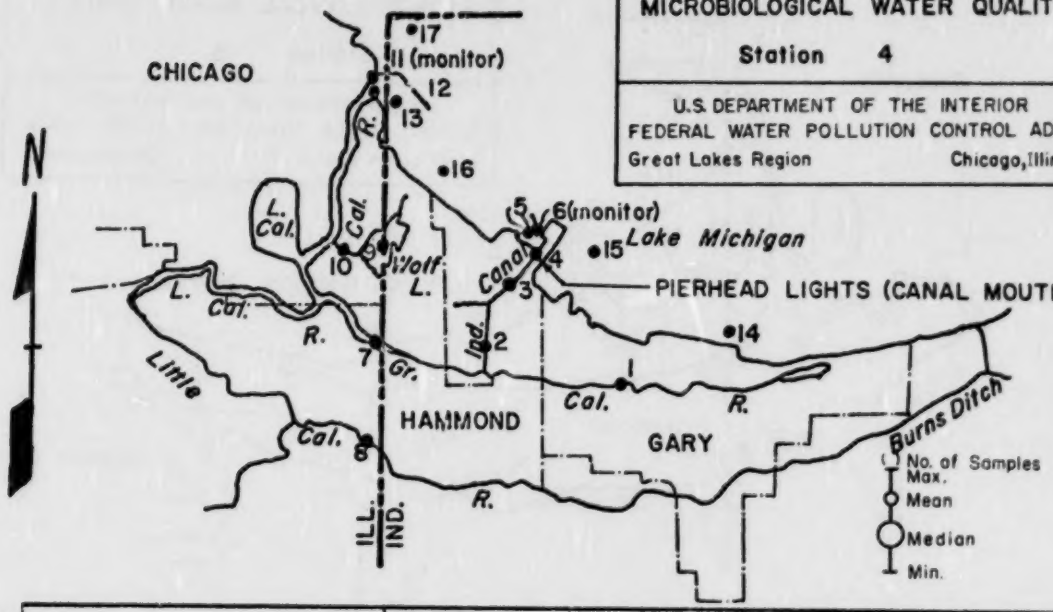
Industrial wastes did not follow a like pattern. As they have in all the Grand Calumet River-Indiana Harbor Canal stations, these parameters have shown a steady increase. Tables 4 and 5 show increased concentrations of ammonia nitrogen, total and soluble phosphates, iron, cyanide, suspended solids and phenols. December 1966 values for phenols and cyanide were very high at Station 6. Higher water temperatures in 1966 than in 1965 may be the result of more cooling water being discharged to the streams. This in itself is not serious but the higher temperatures should result in lower phenols, cyanides and ammonia concentrations because high temperature speeds the decomposition of these compounds. The fact that the concentrations went up when they should have gone down indicates increased discharges to the canal and harbor.

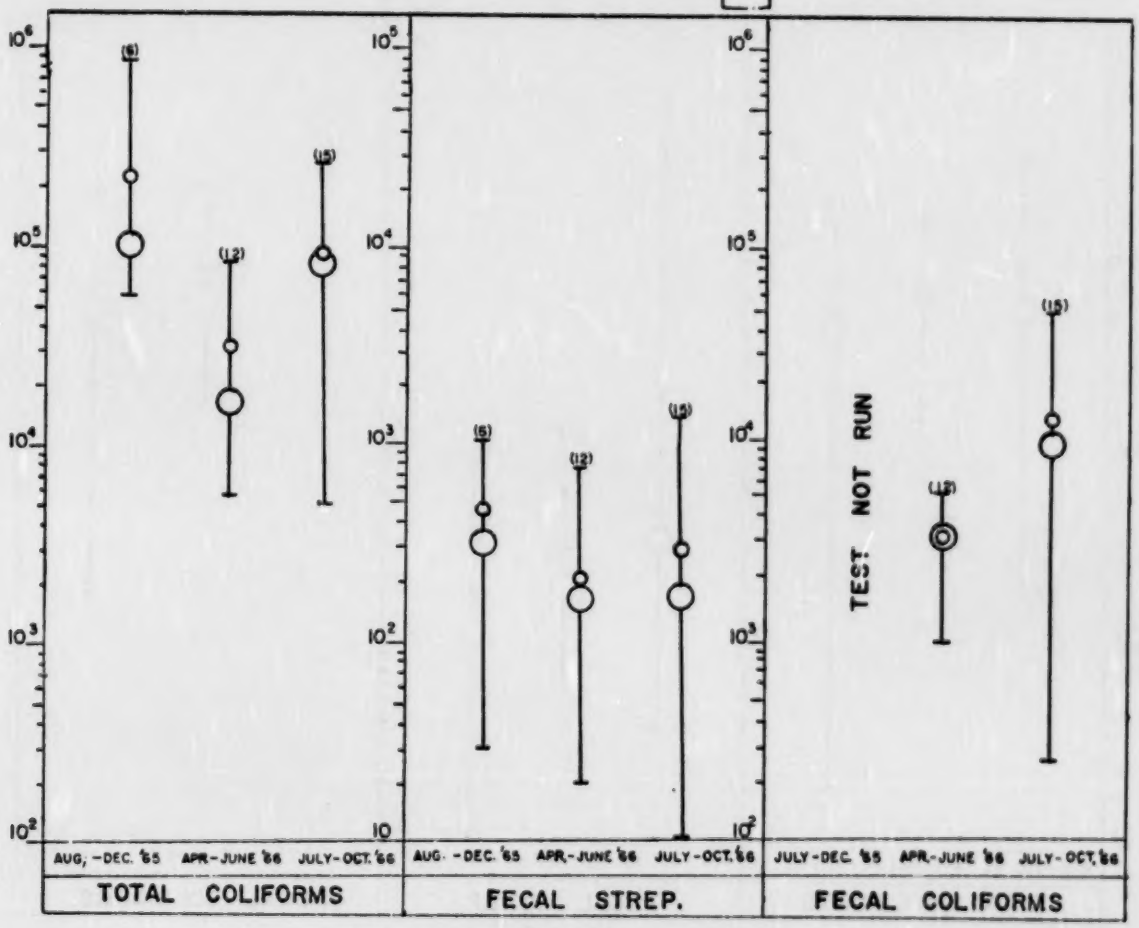
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 4

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



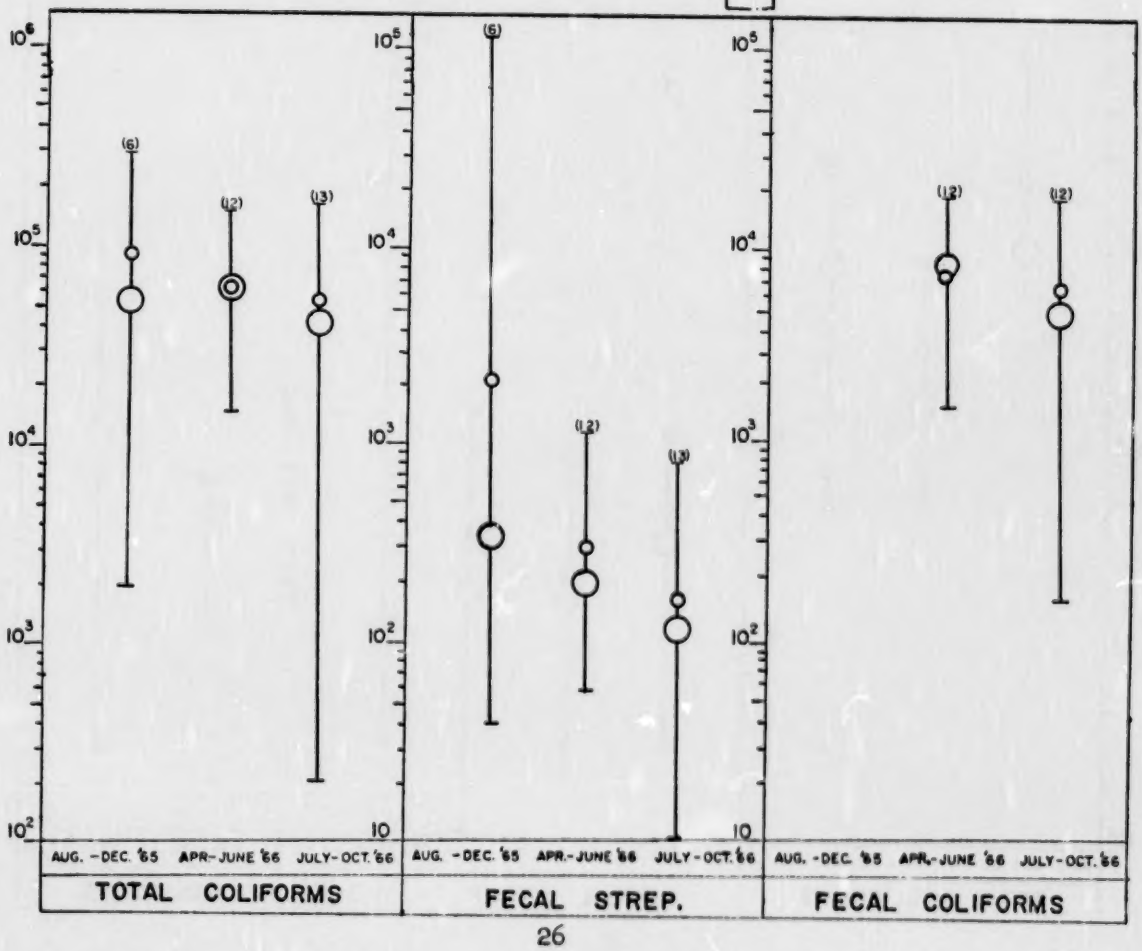


CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 5

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 6

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois

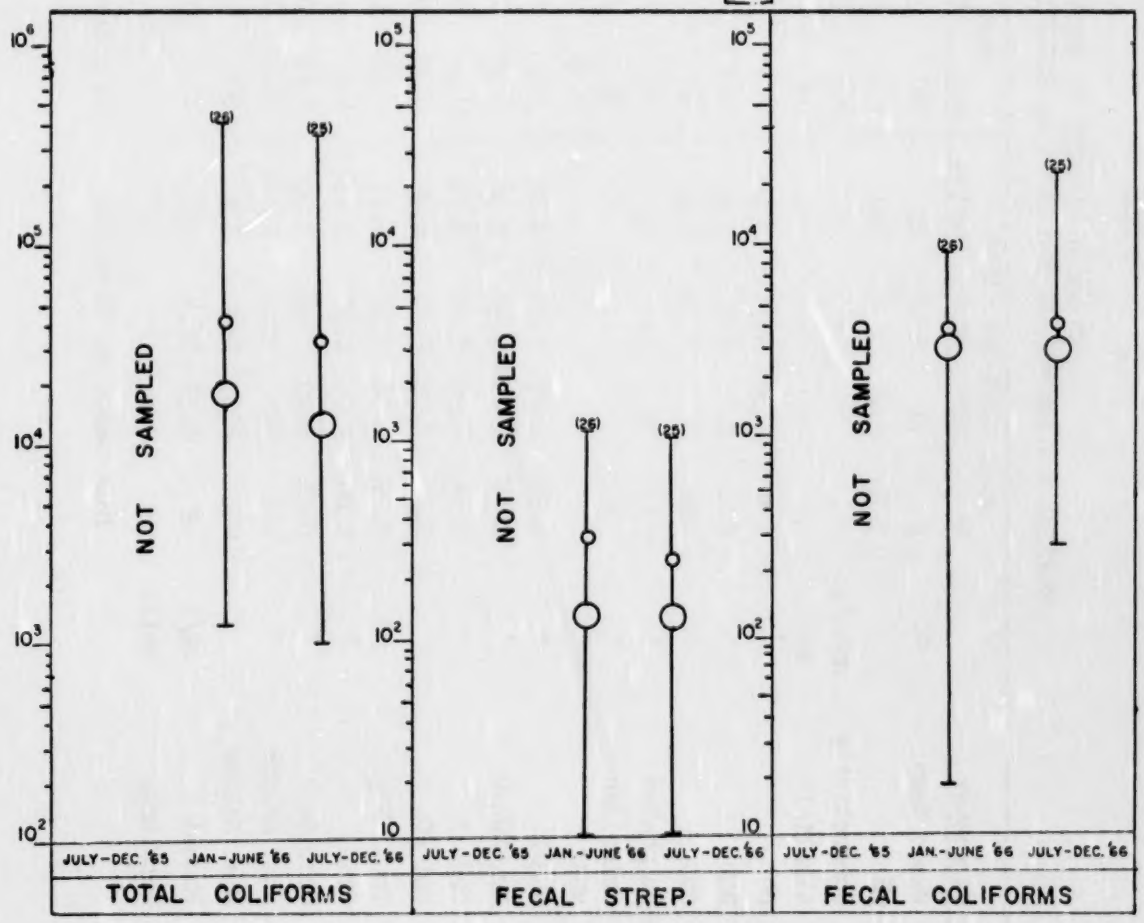


TABLE 4

CHEMICAL QUALITY OF WATER
STATION 4 - INDIANA HARBOR CANAL AT PIERHEAD LIGHTS-IHC 335.7

Parameter		Aug. 1965-Dec. 1965 Max	Min	Mean	Median	Apr. 1966-June 1966 Max	Min	Mean	Median	July 1966-Oct. 1966 Max	Min	Mean	Median
Water Temp.	°C	26	11	20.8	23	24	12	18	19	29	15	24.5	26
pH		7.3	6.8	-	7.1	8.0	6.8	-	7.0	7.4	6.8	-	7.1
Conductivity	umho/cm	-	-	-	-	460	385	419	420	430	301	370	370
Alkalinity	mg/l	-	-	-	-	-	-	-	-	109	51	90.5	98.0
DO	"	6.6	2.36	3.81	3.50	5.2	2.05	3.74	3.60	7.20	0.90	3.43	3.15
BOD	"	9.1	2.8	4.7	3.9	5.0	2.4	3.8	4.1	7.0	2.8	4.06	3.7
COD	"	126	0	37.5	9.3	18	11	13	15	58	6	19.9	16
Sulphates	"	62	34	52	55	84	23	65	70	75	36	52.8	50
Chlorides	"	-	-	-	-	30	21	25	25	23	10	19.9	22
MBAS	"	-	-	-	-	0.25	0.07	0.17	0.17	0.25	0.10	0.176	0.18
NH3-N	"	1.90	0.75	1.21	1.14	5.6	2.2	3.2	3.0	3.8	0.8	2.17	2.1
NO_2+NO_3-N	"	0.74	0.29	0.42	0.38	0.55	0.11	0.31	0.30	0.80	0.17	0.43	0.39
Org. N	"	1.74	0.30	0.94	0.50	0.9	0.0	0.4	0.4	1.4	0.2	0.53	0.5
Sol PO_4	"	0.10	0.03	0.06	0.06	0.19	0.06	0.14	0.15	0.11	0.04	0.07	0.07
Total PO_4	"	0.29	0.08	0.18	0.17	0.27	0.09	0.18	0.20	0.45	0.19	0.27	0.23
Iron	"	5.00	2.00	2.92	2.55	4.9	1.5	3.0	3.0	44	1.2	5.49	2.5
Cyanide	"	0.01	0.00	0.001	0.00	0.25	0.00	0.07	0.07	0.09	0.02	0.04	0.03
Sus. Solids	"	107	11	30.8	13	81	11	21	16	37	7	16.9	15
Dis. Solids	"	253	215	238	235	305	230	263	265	268	130	207	210
Phenol	ug/l	42	5.55	16.4	13	26	11	18	18	84	5	18.4	9
Turbidity	units	-	-	-	-	-	-	-	-	3.4	2.5	-	-
		Data based on 7 samples				Data based on 12 samples				Data based on 15 samples			

TABLE 5

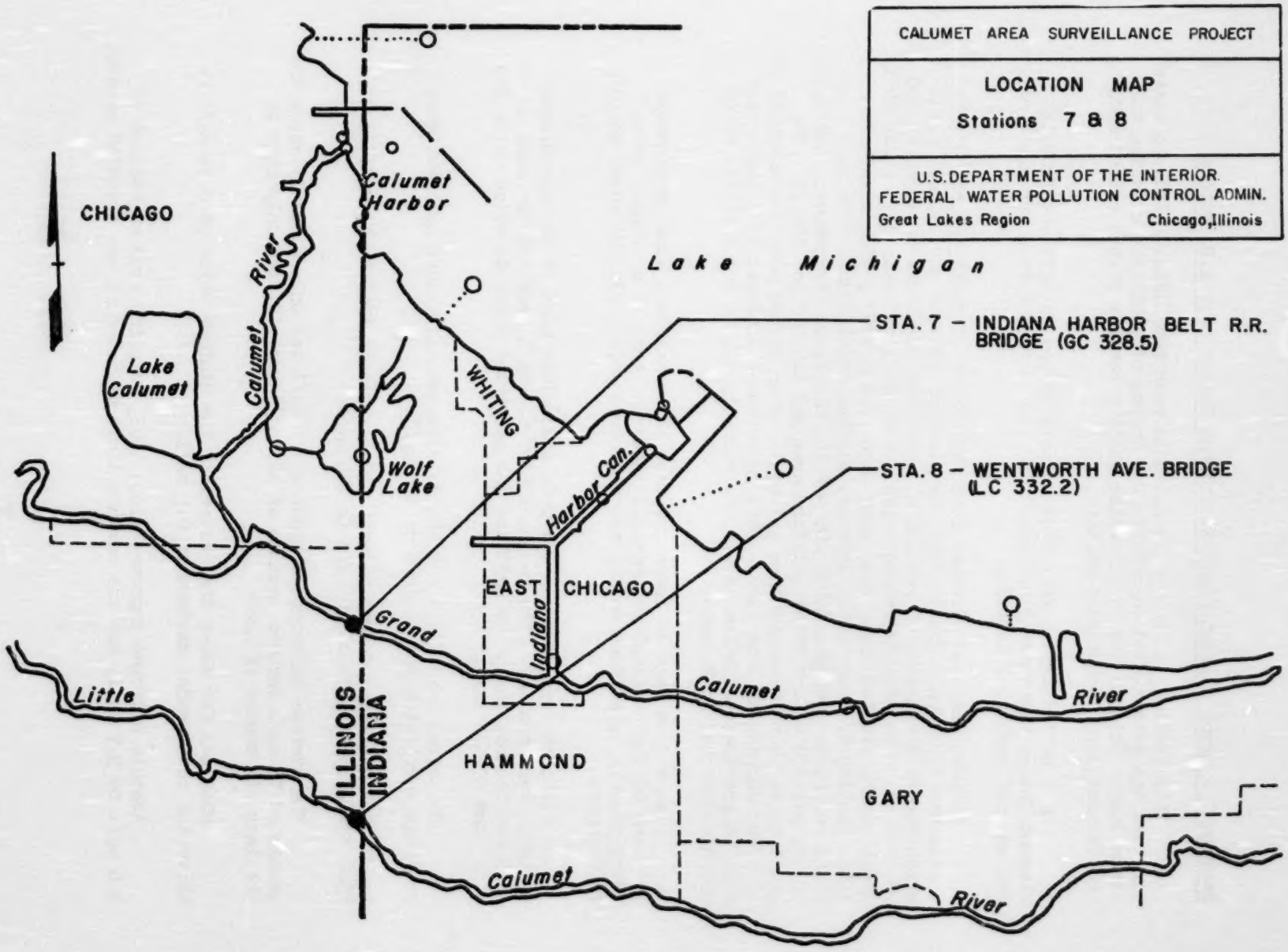
CHEMICAL QUALITY OF WATER
STATION 5 - INDIANA HARBOR AT INNER BREAKWALL LIGHTS-IHC 336.2

Parameter		Aug. 1965-Dec. 1965				Apr. 1966-June 1966				July 1966-Oct. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	26.0	10	20.4	21	23	12	17	17	29	17	24.2	26
pH		7.3	6.8	-	7.1	7.9	6.8	-	7.0	7.3	6.6	-	7.0
Conductivity	umho/cm	-	-	-	-	420	350	384	385	400	330	364	365
Alkalinity	mg/l	-	-	-	-	-	-	-	-	94	72	87	89
DO	"	6.8	1.85	4.58	5.45	6.65	3.05	4.63	4.80	6.00	0.85	3.17	3.10
BOD	"	13.0	2.3	4.4	3.0	5.5	2.0	3.3	3.5	4.4	2.2	3.0	2.9
COD	"	121.0	8.4	37.0	8.6	27	8	13.3	13	28	6	15.2	13
Sulphates	"	56	32	47	50	81	45	62	62	76	41	50.5	48
Chlorides	"	-	-	-	-	26	16	22	23	25	16	21.4	21
MBAS	"	-	-	-	-	0.21	0.10	0.14	0.14	0.21	0.09	0.15	0.14
NH_3-N	"	1.90	0.38	1.04	0.88	4.4	1.5	2.4	2.4	2.9	1.2	1.88	1.8
NO_2+NO_3-N	"	0.59	0.26	0.42	0.44	0.45	0.12	0.29	0.32	5.0	0.14	0.68	0.35
Org. N	"	1.38	0.10	0.69	0.61	0.8	0.00	0.2	0.2	1.5	0.0	0.37	0.3
Sol PO_4	"	0.12	0.03	0.07	0.07	0.11	0.00	0.07	0.08	0.10	0.03	0.055	0.05
Total PO_4	"	0.31	0.06	0.17	0.16	0.19	0.08	0.12	0.14	0.37	0.09	0.18	0.20
Iron	"	2.96	1.25	1.93	1.80	5.6	1.3	3.0	3.1	3.8	1.3	2.37	2.2
Cyanide	"	0.19	0.00	0.03	0.01	0.19	0.01	0.05	0.02	0.14	0.01	0.043	0.03
Sus. Solids	"	13	3.0	7.9	8.0	3.7	9.0	14.8	13	210	1	41	13
Dis. Solids	"	254	230	237	240	280	205	240	235	379	175	228	208
Phenol	ug/l	23	0	6.4	4.9	19	5.4	10.4	10.0	41	3	10.4	7
Turbidity	units	-	-	-	-	11.2	1.8	6.3	6.2	13.0	1.6	5.0	4.2
		Data based on 7 samples				Data based on 12 samples				Data based on 15 samples			

TABLE 6

CHEMICAL QUALITY OF WATER
STATION 6 - INDIANA HARBOR AT EAST BREAKWALL INNER LIGHT
(WATER QUALITY MONITOR STATION)-IHC 336.25

Parameter		July 1965-Dec. 1965 Max	Min	Mean	Median	Jan. 1966-June 1966 Max	Min	Mean	Median	July 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C					19	6	12	12	29	9	19.9	21
pH						8.0	6.6	-	7.0	7.7	6.7	-	7.0
Conductivity	umho/cm					460	320	372	385	470	310	372	360
Alkalinity	mg/l					-	-	-	-	111	79	93	93
DO	"					8.0	2.80	6.50	7.1	8.05	1.15	5.32	5.90
BOD	"					5.6	1.7	3.4	3.6	13.0	1.2	4.09	3.3
COD	"					37	4.0	12.0	11.0	72	5	19.8	15
Sulphates	"					77	34	59	66	70	22	43.6	45
Chlorides	"					32	10	21	22	33	9	20.8	21
MBAS	"					.35	.08	.15	.15	0.30	0.05	0.15	0.14
NH_3-N	"	NOT SAMPLED IN 1965				2.8	0.19	1.9	1.9	2.5	.6	1.5	1.4
NO_2+NO_3-N	"					0.70	0.12	0.42	0.40	.80	.10	.47	.45
Org. N	"					2.1	0.2	0.6	0.5	2.70	.0	.57	.40
Sol PO_4	"					0.30	0.03	0.09	0.08	0.10	0.01	0.05	0.06
Total PO_4	"					0.34	0.08	0.14	0.13	1.40	.08	0.25	0.19
Iron	"					8.1	1.3	3.1	3.0	15.0	1.1	3.72	2.5
Cyanide	"					0.20	0.00	0.08	0.07	0.35	0.00	0.07	0.03
Sus. Solids	"					46	8	17	15	119	.7	26.2	16
Dis. Solids	"					265	200	239	240	266	128	211	215
Phenol	ug/l					45	1.4	15.6	14	422.	2.	27.0	7
Turbidity	units					-	-	-	-	55.0	1.6	17.8	16.5
						Data based on 26 samples				Data based on 25 samples			


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 7 & 8
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
Calumet Harbor
Calumet River
Lake Michigan
STA. 7 – INDIANA HARBOR BELT R.R. BRIDGE (GC 328.5)
Lake Calumet
WHITING
Wolf Lake
Harbor Can.
STA. 8 – WENTWORTH AVE. BRIDGE (LC 332.2)
EAST CHICAGO
Grand
Indiana
Little
Calumet
River
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet
River

Station 7 - Grand Calumet River at Indiana Harbor Belt R.R. Bridge

This station is located in Illinois near the Illinois-Indiana state line and was established to measure the amount of pollution crossing the state line. This is one of the water quality control points established by the Calumet Area Technical Committee.

Most of the dry weather flow in this stream is effluent from the Hammond Sewage Treatment Plant and industrial effluent from one steel mill and several smaller industries.

Between July and November 1966 the microbiological quality of the stream was improved. Total coliforms averaged 258,000 per 100 ml. Fecal streptococci averaged 2400 per 100 ml and fecal coliforms averaged 48,000 per 100 ml. The graph"Microbiological Water Quality Station 7" shows that these counts are far lower than they were during 1965 or January-December 1966. During December 1966, however, the bacterial counts were much higher. Total coliforms averaged 1,440,000 per 100 ml, fecal streptococci averaged 46,700 per 100 ml and fecal coliform averaged 410,000 per 100 ml. The graph shows that these averages are equal to or higher than the averages of 1965 and January to June 1966. This improvement followed by a regression back to previous pollution levels was probably due to chlorination which was discontinued in December.

Table 7 on page 34 indicates that there has been some improvement for some of the chemical parameters; however, organic nitrogen, total iron, phenols, suspended solids and dissolved solids all increased sharply in December.

Although some progress was made since 1965 most of the recommended criteria were not met. The median BOD of 6.2 mg/l remained the same as in 1965 but the maximum of 89 mg/l was far above the criteria which calls for a maximum of 10 mg/l.

Dissolved oxygen did not change substantially since 1965 but many readings were below the minimum of 1.0 mg/l.

COD was reduced from a median of 52 mg/l in 1965 to 41 mg/l in 1966 and sulphates from 190 mg/l to 174 mg/l.

The average chlorides content of 77 mg/l was only slightly above the permitted 75 mg/l and the maximum of 125 mg/l was violated only once in the last six months of 1966.

MBAS was far above the criteria. The minimum value of 0.54 mg/l is above the recommended maximum of 0.5 mg/l.

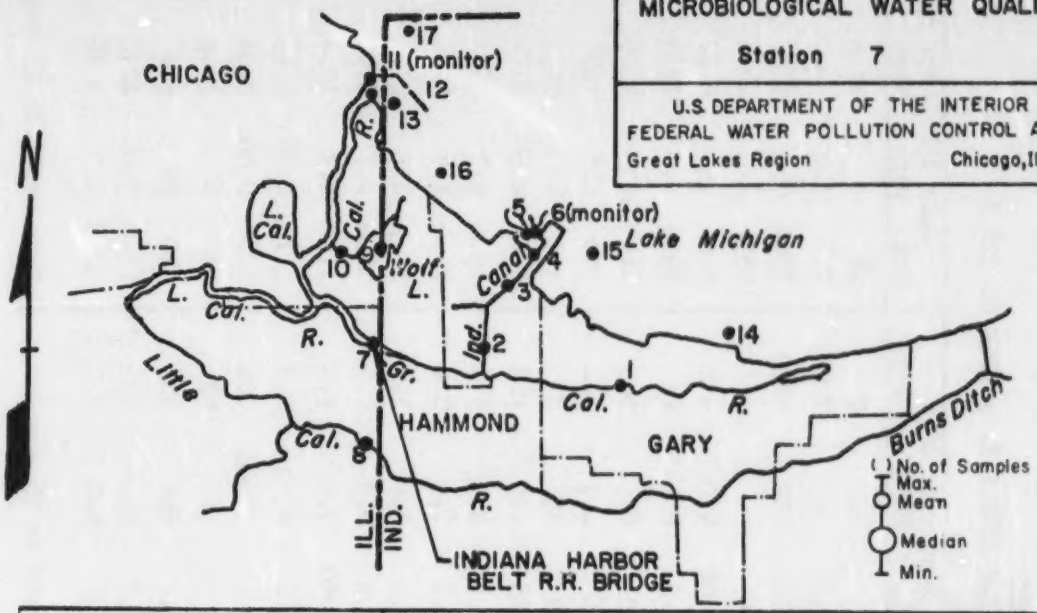
Ammonia nitrogen improved since 1965, dropping from an average of 4.6 mg/l to 3.7 mg/l, but the maximum limit of 5.0 mg/l was exceeded several

CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 7

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



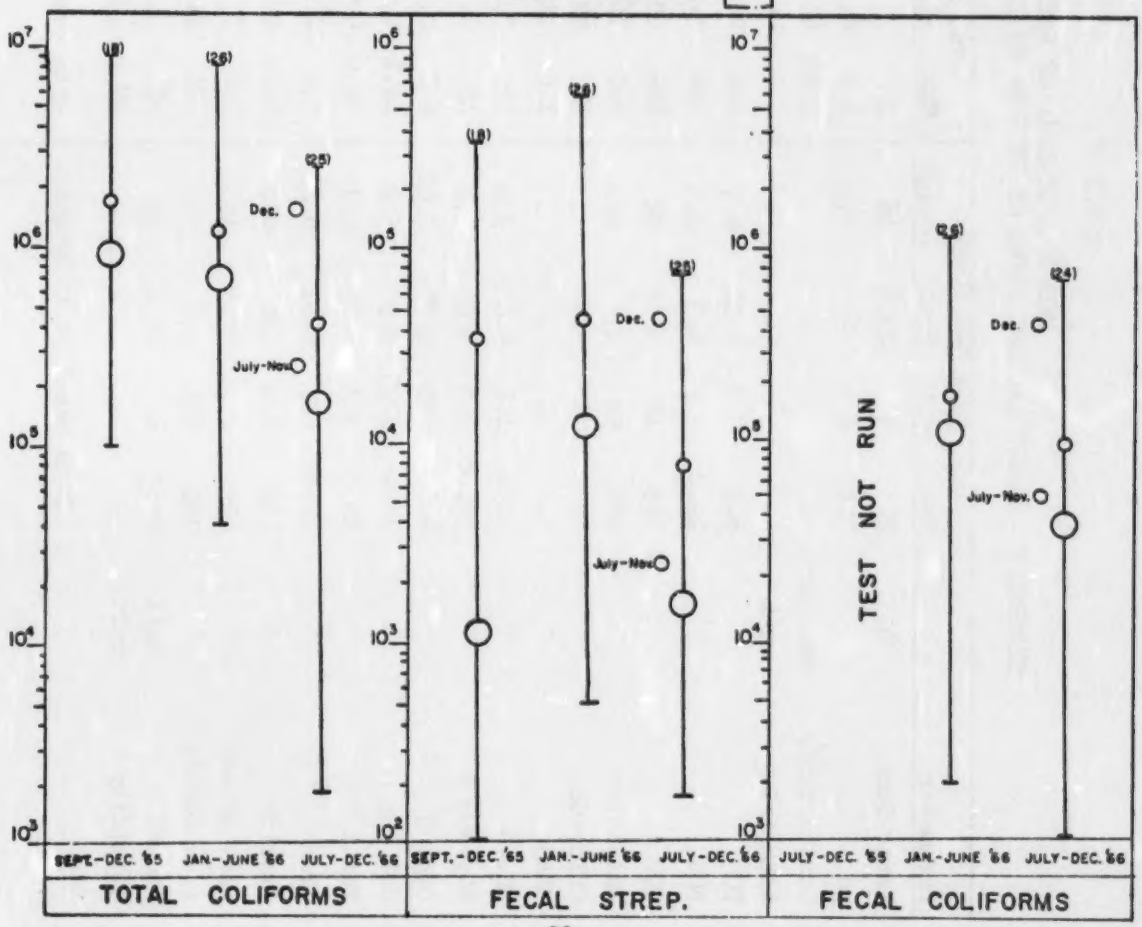


TABLE 7

CHEMICAL QUALITY OF WATER
STATION 7 - GRAND CALUMET RIVER AT INDIANA HARBOR BELT R.R. BRIDGE GC 328.5

Parameter		Sep. 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	21	5	13.4	16	23	3	11	9	28	5	17.0	17
pH		7.4	6.5	-	7.2	8.2	6.8	-	7.2	7.3	7.0	-	7.2
Conductivity	umho/cm	-	-	-	-	1150	410	922	1020	1500	690	975	940
Alkalinity	mg/l	-	-	-	-	-	-	-	-	253	121	181	170
DO	"	8.0	0.0	4.12	4.7	6.4	0.00	4.00	4.2	9.6	.5	4.12	3.65
BOD	"	24.0	3.5	8.3	6.1	104	3.2	26.4	21	89.0	2.6	13.3	6.2
COD	"	155	15	56.4	52	224	25	67	56	114	13	47.6	41
Sulphates	"	282	52	174	190	280	76	187	192	205	115	169	174
Chlorides	"	-	-	-	-	180	22	87	85	150	52	77	78
MBAS	"	-	-	-	-	1.8	.15	.70	.63	1.14	0.54	0.74	0.70
NH_3-N	"	11.0	1.2	4.6	3.2	12	0.55	4.72	3.9	13.0	0.3	3.7	2.4
NO_2+NO_3-N	"	13.00	1.2	5.0	3.8	15	1.1	6.3	6.4	14.0	1.6	6.4	5.0
Org. N	"	4.60	.05	1.70	1.60	6.6	0.6	2.4	1.9	11.9	0.5	2.1	1.1
Sol PO_4	"	11.0	1.25	5.9	5.9	10.1	0.3	2.9	2.0	16.0	0.7	8.9	8.4
Total PO_4	"	14.0	3.3	8.2	7.9	16.0	0.90	7.67	7.0	17.0	4.3	10.9	11.0
Iron	"	17.00	.27	2.01	0.80	7.9	0.6	2.13	1.3	3.10	0.26	0.73	0.49
Cyanide	"	.12	0.0	.01	0.0	0.05	0.0	.0096	.01	0.04	0.00	0.01	0.01
Sus. Solids	"	155	7	27.4	18	110	5	38	28	51	4	15.8	13
Dis. Solids	"	750	185	606	660	770	270	668	700	740	90	560	590
Phenol	ug/l	45.5	4.	15.4	13	90	3.1	24.4	19	66.0	3.0	12.3	8.0
Turbidity	units	-	-	-	-	19.5	1.8	6.2	5.1	30.0	1.0	4.74	2.2
		Data based on 18 samples				Data based on 26 samples				Data based on 25 samples			

times, especially in December.

Total and soluble phosphates both increased since 1965. Soluble phosphate from an average of 5.9 mg/l to 8.9 mg/l and total phosphate from an average of 8.2 mg/l to 10.9 mg/l. A criterion for phosphate has not yet been recommended.

Total iron decreased substantially but cyanide was detected more often in 1966 than in 1965.

Suspended and dissolved solids both decreased but dissolved solids were above the recommended maximum of 500 mg/l.

The phenolic content decreased to an average of 12.3 ug/l in 1966, but the maximum allowable of 20 ug/l was exceeded in all three December 1966 samples.

Floating oil, sludge banks and gas bubbles were frequently reported at this station.

The water quality of the stream had shown considerable improvement during 1966 and several parameters were approaching their criteria levels until December when concentrations rose sharply.

The samples for this station were composited on a monthly basis and analyzed for heavy metals. The following are average values for the last six months of 1966:

Cadmium	less than 0.005	mg/l
Copper	0.03	"
Potassium	9.3	"
Chrome	less than 0.005	"
Manganese	0.09	"
Lead	less than 0.005	"
Nickel	0.01	"
Arsenic	less than 0.001	"
Zinc	0.04	"
Sodium	79	"

Station 8 - Little Calumet River at Wentworth Avenue

The Wentworth Avenue Station was established to monitor the wastes in the Little Calumet River flowing from Indiana to Illinois. The station is located approximately one half mile downstream from the state line and is one of the control points established by the Calumet Area Technical Committee.

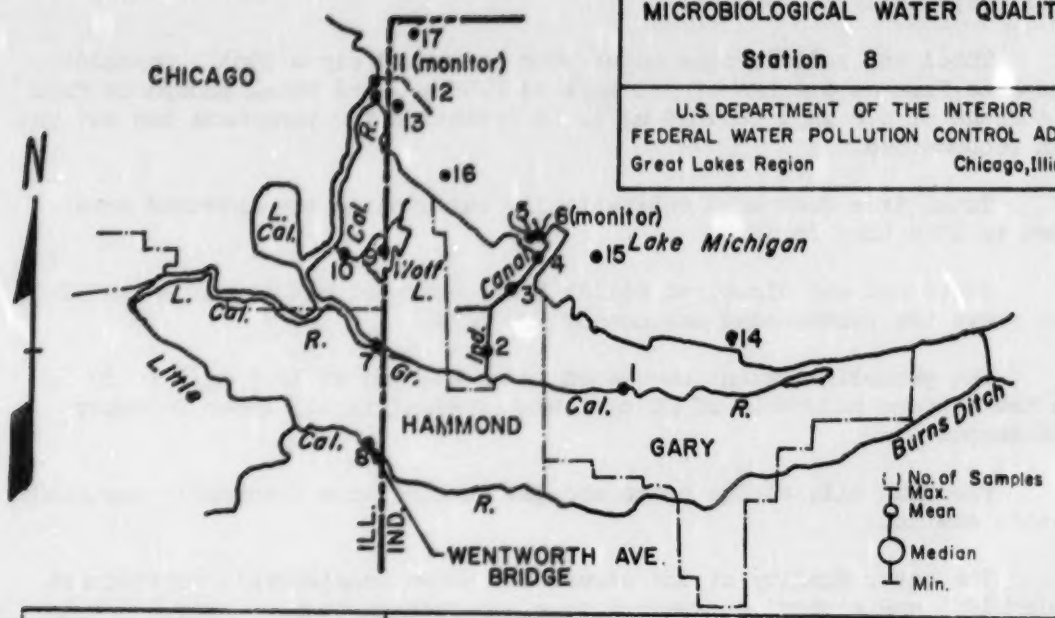
Improvement in microbiological quality reported in the January-June 1966 report has continued. The graph on page 36 shows that the coliform

CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 8

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region — Chicago, Illinois



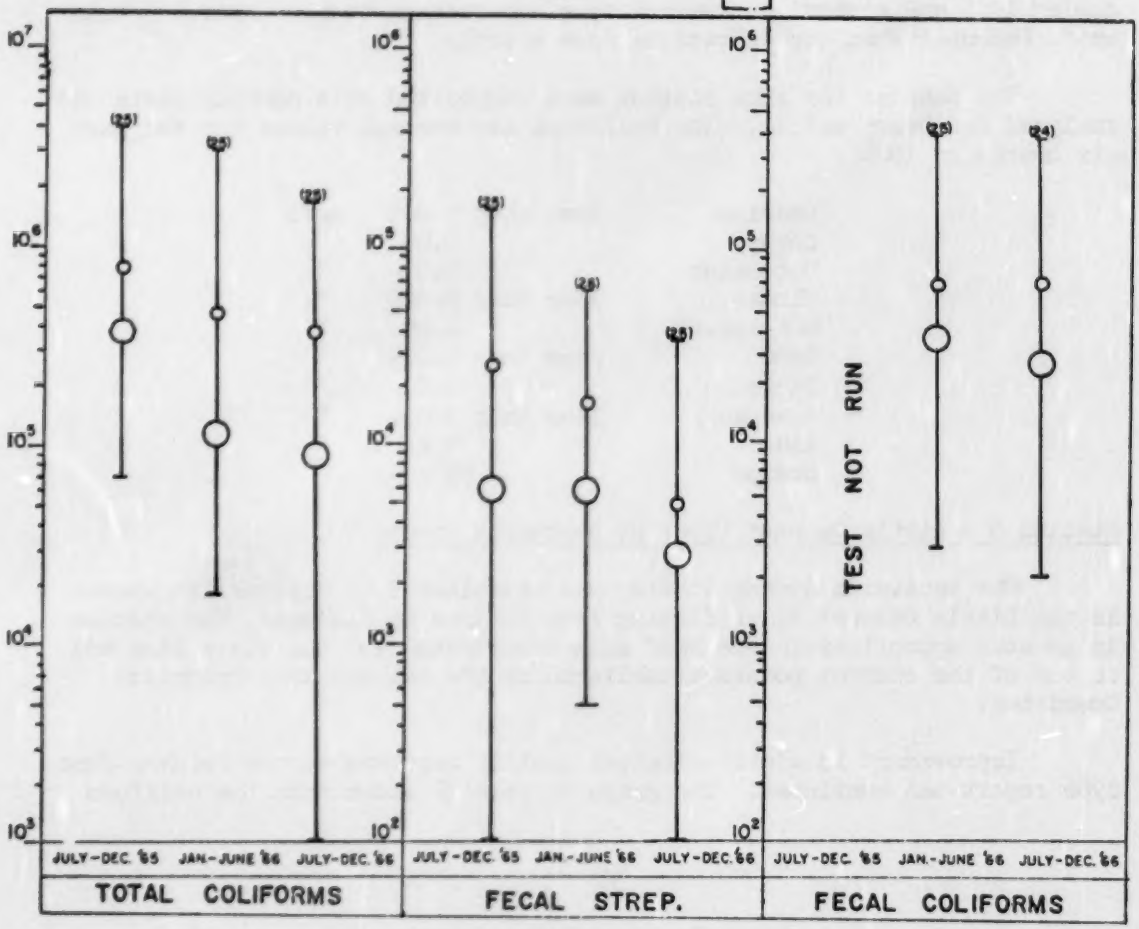


TABLE 8

CHEMICAL QUALITY OF WATER
STATION 8 - LITTLE CALUMET RIVER AT WENTWORTH AVE.-LC 332.3

Parameter		July 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	24	0	13.3	17	23	0	8	7	30	1	13.9	14
pH		8.8	7.1	-	7.4	8.0	7.0	-	7.5	8.1	6.9	-	7.5
Conductivity	umho/cm	-	-	-	-	1220	425	808	765	1300	430	1025	1100
Alkalinity	mg/l	-	-	-	-	-	-	-	-	307	65	220	242
DO	"	9.80	0.00	3.32	3.10	11.0	0.2	6.4	7.3	9.60	0.10	3.49	2.50
BOD	"	35.0	3.9	10.9	8.1	16	3.9	8.2	7.8	17.0	5.0	9.5	8.5
COD	"	151.0	5.9	50.9	51	89	20	45	39	72	19	45.7	50
Sulphates	"	310	57	175	175	300	101	187	180	325	100	216	205
Chlorides	"	-	-	-	-	55	17	41	44	80	18	52.3	54
MBAS	"	-	-	-	-	.76	.15	.28	.25	0.86	0.28	0.45	0.42
NH_3-N	"	3.70	.30	1.96	2.05	3.1	.35	1.4	1.4	6.0	0.3	2.57	2.4
NO_2+NO_3-N	"	5.40	.04	1.68	1.40	4.3	.12	1.7	1.8	9.3	0.10	1.62	0.60
Org. N	"	6.23	.13	2.58	1.60	2.95	0.8	1.7	1.4	7.2	0.3	1.78	1.5
Sol PO_4	"	9.71	.26	3.07	2.90	3.1	0.0	1.4	1.1	9.9	0.6	5.5	5.7
Total PO_4	"	14.28	1.10	4.60	4.30	6.9	.22	3.5	3.0	11.0	1.8	6.3	6.4
Iron	"	3.80	0.45	1.26	0.91	3.1	.44	1.0	.91	2.30	0.38	0.75	0.63
Cyanide	"	.18	0.0	0.012	0.0	.02	.00	.005	.00	0.66	0.00	0.3	0.00
Sus. Solids	"	704	10	105.5	30	980	13	89	32	320	5	38.1	18
Dis. Solids	"	770	109	565	637	860	255	595	570	907	194	652	741
Phenol	ug/l	59.0	0.0	10.9	7.9	39	.24	12.4	9.3	65.0	1.0	9.6	6.1
Turbidity	unit	-	-	-	-	103	1.2	15.6	9.0	80.0	1.0	8.7	4.0
		Data based on 25 samples				Data based on 25 samples				Data based on 25 samples			

and fecal streptococci counts were slightly lower during the last half of 1966. This slight decrease is significant because an increase would normally be expected due to the higher temperatures. The average temperature during January-June 1966 was 8°C and during July-December 1966 it was 13.9°C. There were still several total coliform counts over 1,000,000 per 100 ml, however, and all the counts were higher than the maximum bacterial criteria. Overflows from combined sewers are still a severe problem.

The chemical data reveal no clear trend. Some are higher, some are lower than in the preceeding six months; most do not meet the recommended criteria. The criteria for water temperature and pH were met. The dissolved oxygen is far below the minimum level called for by the criteria. The average BOD and COD both decreased slightly since 1965, as did suspended solids, iron and phenols. Sulphates, ammonia, phosphates, cyanide and dissolved solids all increased appreciably, however.

The recommended criterion for BOD calls for a maximum of 10.0 mg/l. This was exceeded on several occasions especially during July and August.

The maximum of 0.5 mg/l for MBAS was also exceeded several times.

The criterion for ammonia nitrogen (maximum 1.5 mg/l) was exceeded on most of the samples.

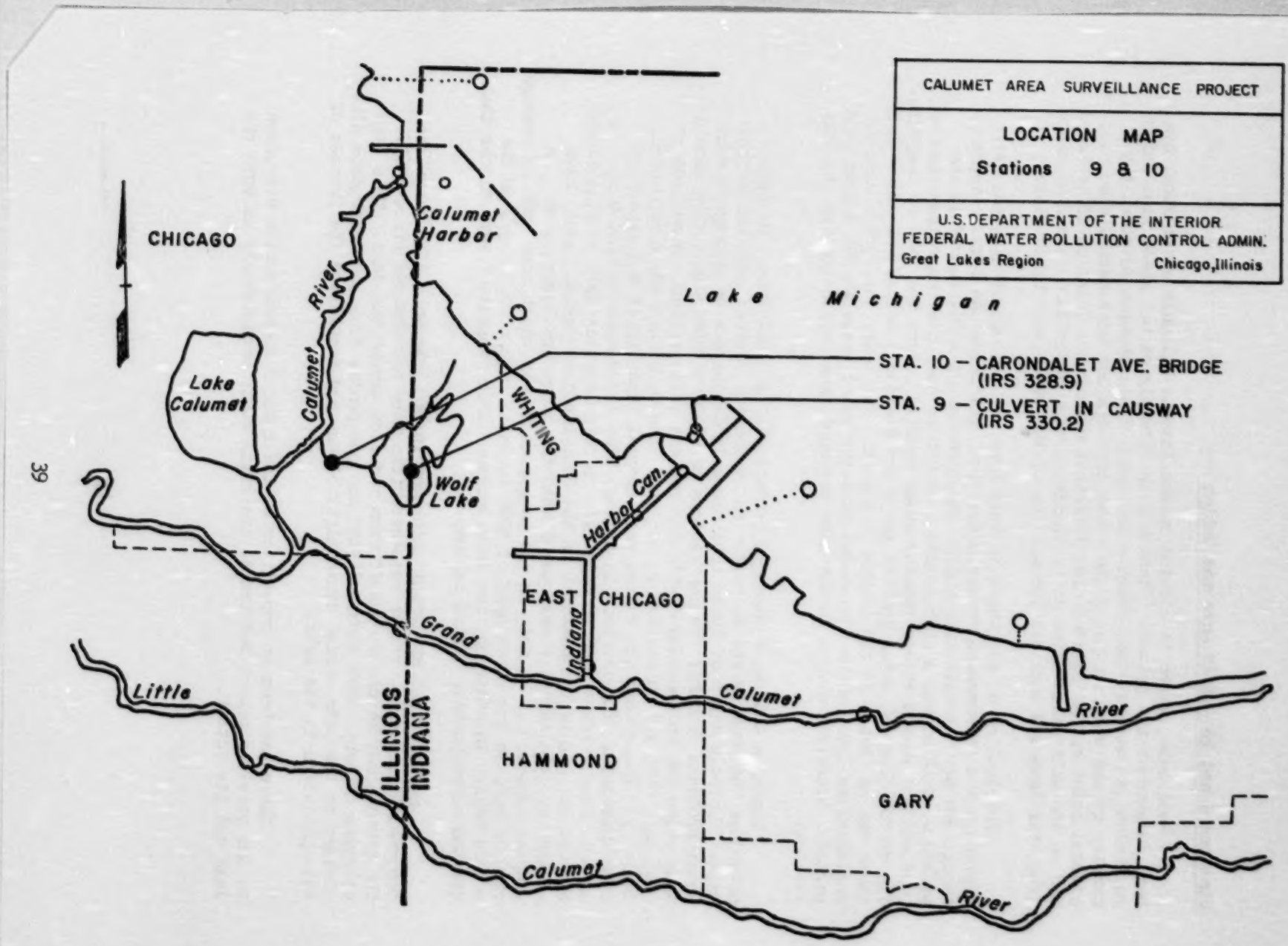
The criterion for cyanides (maximum 0.025 mg/l) was generally met, except for one occasion when 0.66 mg/l was found.

The criterion for phenolic compounds (maximum 20 ug/l) was also generally met, except for one sample.

The criteria call for the stream to be substantially free of floating solids, sludge banks and visibly floating oil. Floating oil and solids have been frequently observed and gas bubbles indicate the presence of sludge banks.

Samples for this station were composited on a monthly basis and analyzed for heavy metals. The following are average values for the last six months of 1966:

Cadmium	less than 0.005	mg/l
Copper	0.07	"
Potassium	6.8	"
Chrome	0.06	"
Manganese	0.23	"
Lead	0.02	"
Nickel	0.20	"
Arsenic	less than 0.001	"
Zinc	0.03	"
Sodium	68	"


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 9 & 10
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
Calumet Harbor
Lake Michigan
Calumet River
Lake Calumet
STA. 10 – CARONDALET AVE. BRIDGE (IRS 328.9)
STA. 9 – CULVERT IN CAUSWAY (IRS 330.2)
WHITING
Wolf Lake
Harbor Can.
EAST CHICAGO
Indiana
Grand
Little
Calumet River
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet River

Stations 9 and 10 - Wolf Lake and Outlet

Wolf Lake, which is located on the Indiana-Illinois state line, has been sampled at two points. Station 9 is directly on the state line which runs along a causeway that bisects the lake. This station monitors the quality of the water crossing the state line and has been established as a control point by the Calumet Area Technical Committee. Station 10 is located on the Wolf Lake outlet at Carondolet Avenue about 3000 feet downstream from Wolf Lake and monitors the quality of the water leaving the lake.

The quality of the water in Wolf Lake and its outlet is good. At Station 9 the recommended criteria for total coliforms and fecal streptococci were met approximately 95% of the time during 1966. Runoff is the probable cause of the higher counts. On two of the three occasions they were not met it was either raining at or shortly before the time of sampling. The microbiological water quality graph for Station 9 on page 41 shows that there was no change in the counts last year. The lower coliform counts in January-June 1966 can be attributed to lower water temperatures during this period. Dissolved oxygen in the lake was more than sufficient and the BOD was low.

Floating suds were observed periodically on Wolf Lake. On two occasions the problem was so severe as to prevent recreational use of the lake. Probable cause of these conditions is discharges of detergent from Lever Brothers Company. Concentrations of MBAS and phosphates were considerably above the recommended levels and reflect this problem. A maximum of 0.05 mg/l MBAS and an average of not more than 0.02 mg/l are recommended. Table 9 shows that the values were several times higher and appear to have increased. The increase in average MBAS concentration from 0.12 mg/l in January-June 1966 to 0.14 mg/l in July-December 1966 is significant because the higher temperatures in the July-December period should have caused more biological breakdown of MBAS and therefore lower counts. A similar comment can be made on the phosphate levels which rose from an average of 0.11 mg/l in the first half of 1966 to an average of 0.20 mg/l in the second half. In addition, the July-December 1966 phosphates were higher than for the corresponding period in 1965.

Concentrations of ammonia nitrogen in the lake were also above the recommended criteria. These concentrations have not changed since 1965. The ammonia may be due to runoff from the area around the lake. This high nitrogen content, when combined with the phosphates from the detergents discharged to the lake, could cause algal blooms and accelerate the process of eutrophication in the lake.

There has been no repetition of the cyanide contamination discussed in the previous report but traces are still found occasionally in both the lake and its outlet.

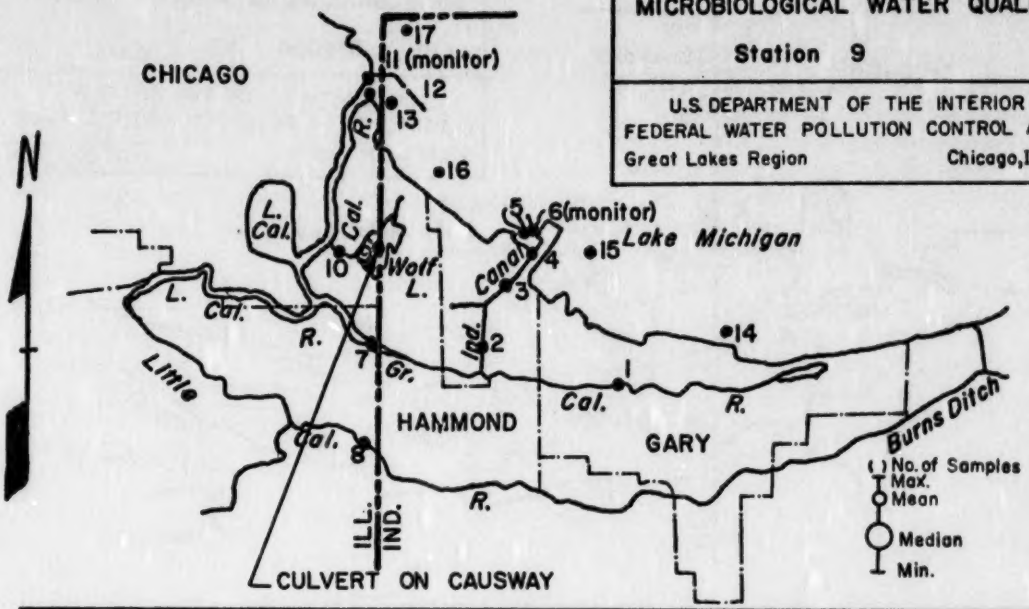
GPO 802-302-8

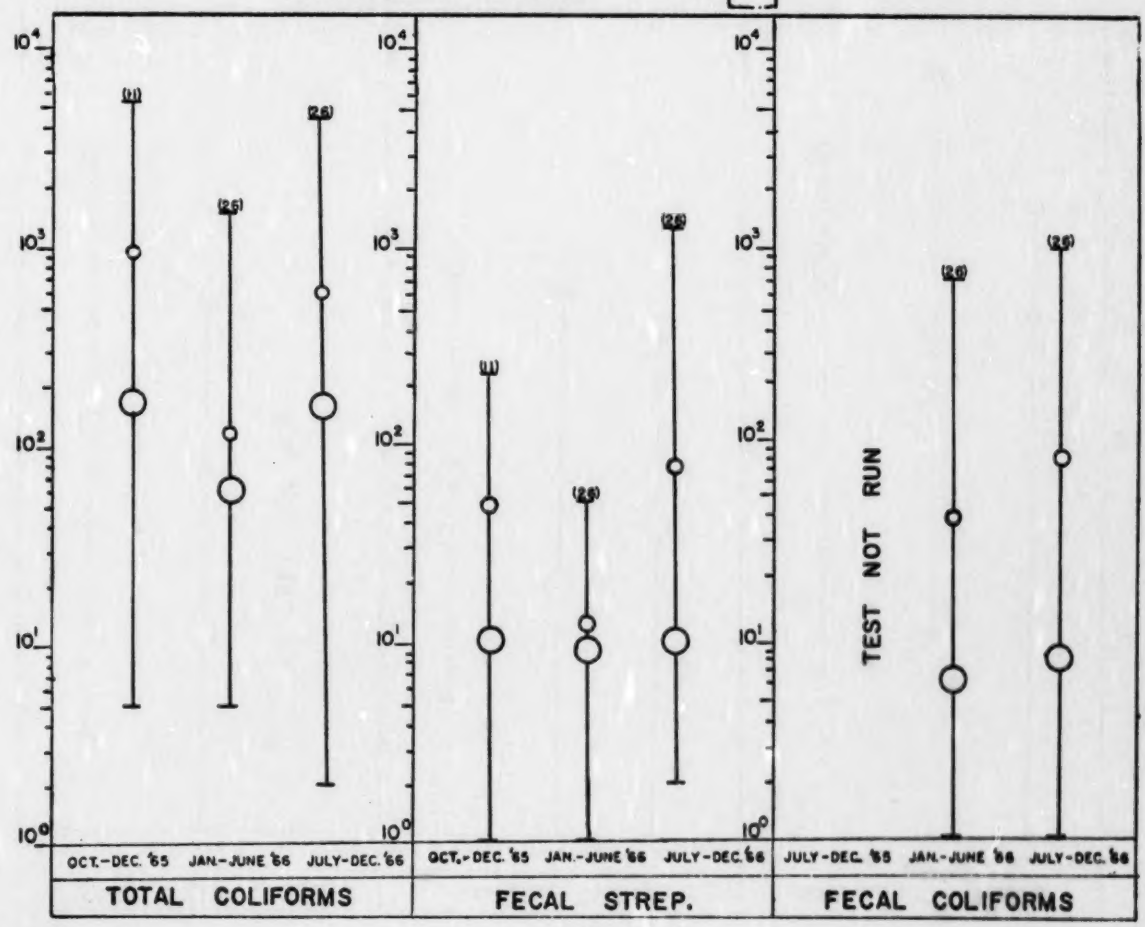
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 9

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



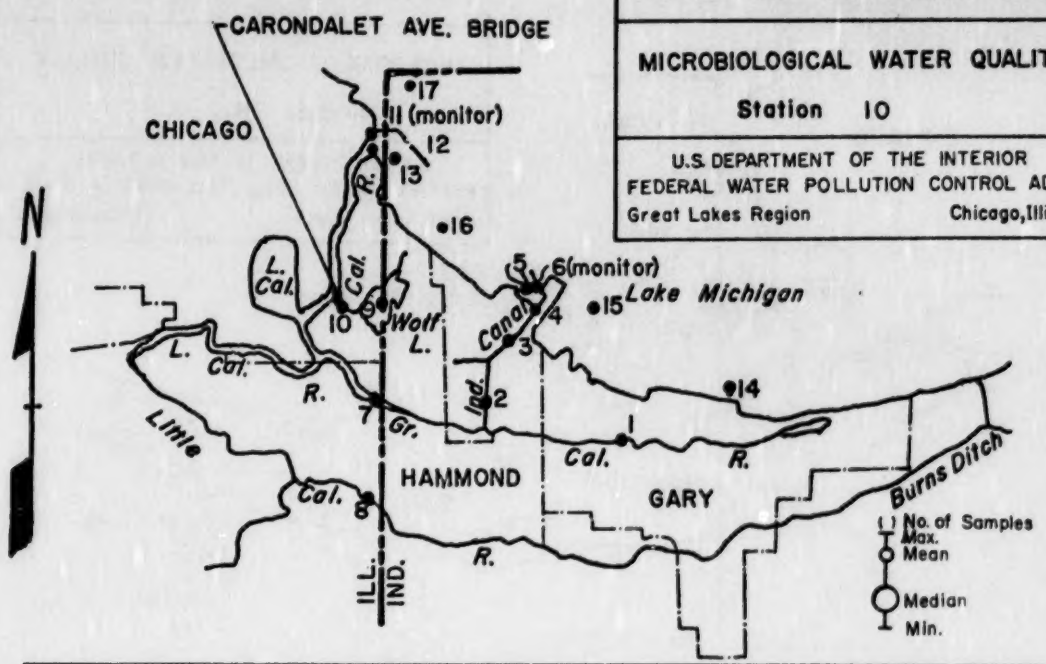


CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 10

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



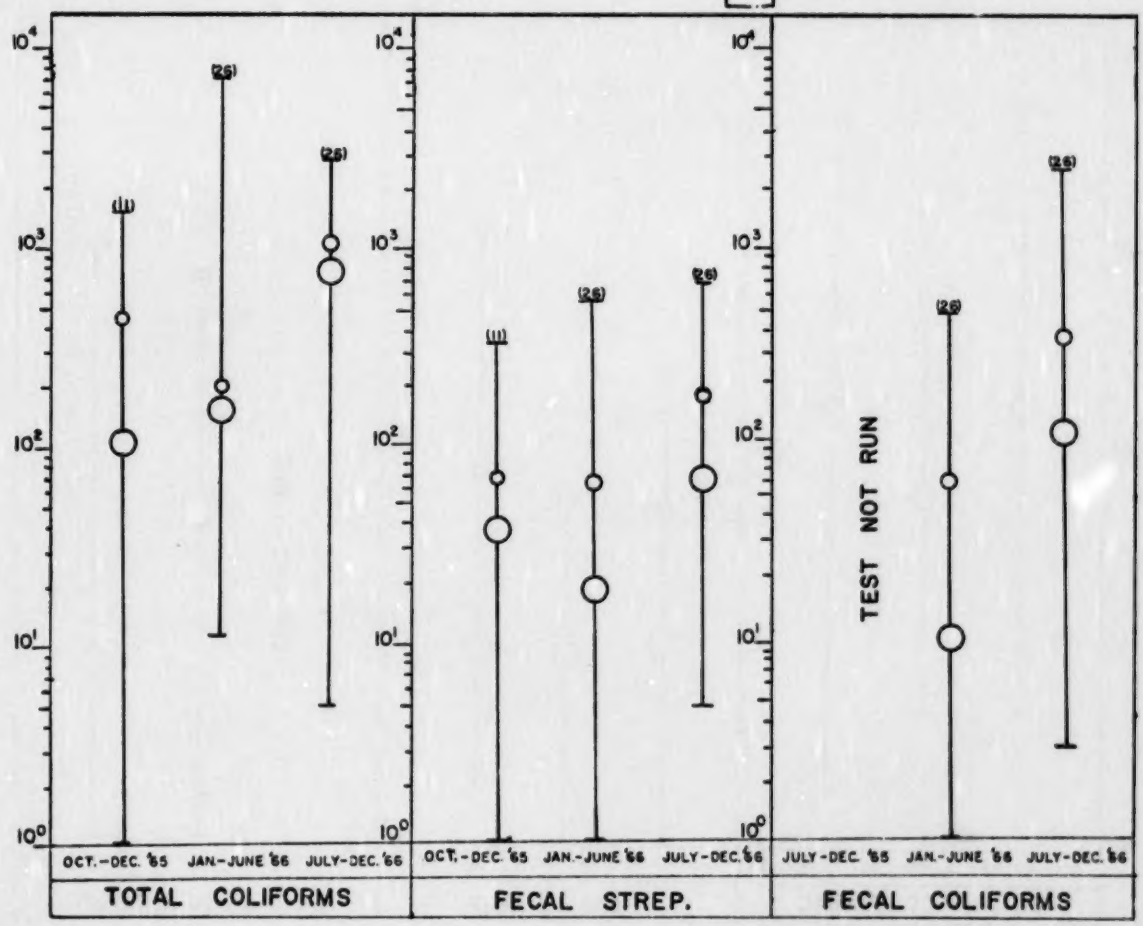


TABLE 9

CHEMICAL QUALITY OF WATER
STATION 9 - WOLF LAKE AT CULVERT ON INDIANA-ILLINOIS STATE LINE-IRS 330.2

Parameter		Oct. 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	15	0	4.1	1	24	0	8	5	29	0	13	12
pH		8.2	7.7	-	7.9	9.8	7.5	-	8.0	8.9	7.4	-	8.1
Conductivity	umho/cm	-	-	-	-	460	350	414	400	500	335	391	385
Alkalinity	mg/l	-	-	-	-	-	-	-	-	450	92	156	111
DO	"	15.0	10.0	12.6	13.0	15	7.70	11.04	11.2	14.20	7.10	10.53	10.52
BOD	"	5.5	1.2	3.2	3.4	7.8	1.9	3.9	3.7	11.0	1.6	5.6	6.0
COD	"	134	6.4	42	23	26	10	18	18	55	15	32.5	30
Sulphates	"	60	46	50	50	69	45	55	55	61	37	46.6	46
Chlorides	"	-	-	-	-	38	27	31	30	34	20	26.8	27
MBAS	"	-	-	-	-	.19	.10	.12	.11	0.19	0.09	0.14	0.14
NH_3-N	"	0.38	0.07	0.24	0.22	.56	.02	.28	.30	0.54	0.03	0.22	0.20
NO_2+NO_3-N	"	0.86	0.38	0.58	0.55	1.2	.03	.38	.30	0.99	0.10	0.34	0.26
Org. N	"	1.00	0.45	0.69	0.68	1.19	.51	.76	.71	2.00	0.55	1.20	1.10
Sol PO_4	"	0.29	0.02	0.10	0.09	.07	.00	.02	.02	0.29	0.05	0.14	0.14
Total PO_4	"	0.30	0.06	0.13	0.12	.34	.04	.11	.08	0.48	0.08	0.20	0.19
Iron	"	0.97	0.08	0.28	0.23	.56	.04	.24	.22	0.74	0.05	0.25	0.24
Cyanide	"	0.01	0.00	0.00	0.00	.35	.00	.01	.00	0.03	0.00	0.001	0.00
Sus. Solids	"	51	2	11	9	48	4	13	9	31	4	15.3	14
Dis. Solids	"	285	255	264	265	320	180	268	265	275	184	230	225
Phenol	ug/l	20	0.00	4.2	4	19	.14	3.05	2	18	0	3.4	3
Turbidity	units	-	-	-	-	4.2	0.5	2.3	2.1	12.0	1.3	4.2	4.0
		Data based on 11 samples				Data based on 26 samples				Data based on 26 samples			

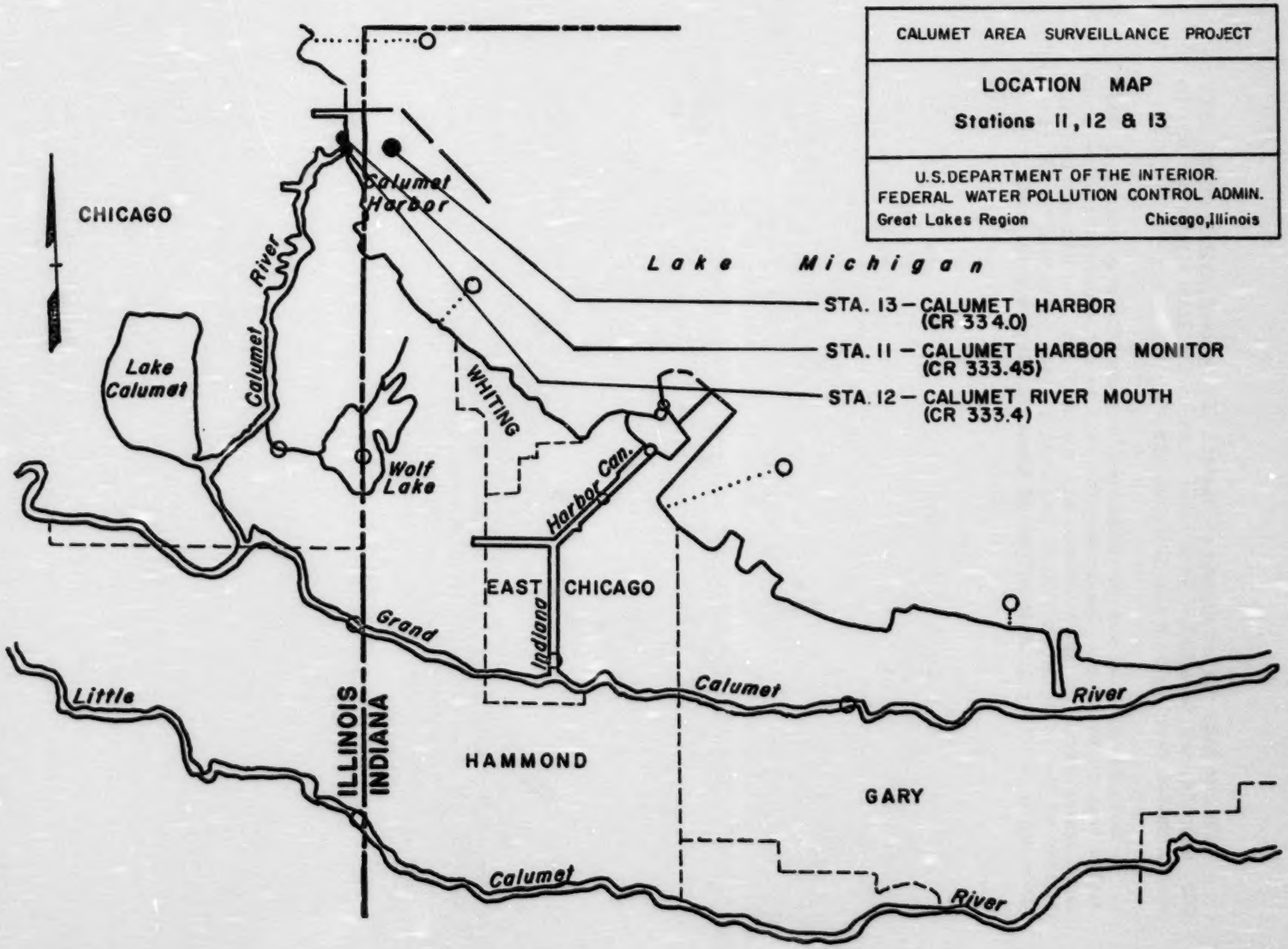
TABLE 10

CHEMICAL QUALITY OF WATER
STATION 10 - WOLF LAKE CHANNEL AT CARONDOLET AVE.-IRS 328.9

Parameter		Oct. 1965-Dec. 1965				Jan. 1966-June 1966				July 1966-Dec. 1966			
		Max	Min	Mean	Median	Max	Min	Mean	Median	Max	Min	Mean	Median
Water Temp.	°C	16	1	4.6	3	25	0	8	5	28	0	14	13
pH		8.6	8.1	-	8.4	8.8	7.9	-	8.5	8.7	8.0	-	8.4
Conductivity	umho/cm	-	-	-	-	545	370	463	460	520	350	440	445
Alkalinity	mg/l	-	-	-	-	-	-	-	-	121	83	104	102
DO	"	13	8.0	11.4	12.0	14.0	5.9	10.6	11.4	13.30	5.95	9.35	9.70
BOD	"	2.6	1.7	2.2	2.1	5.0	1.9	3.1	3.3	7.6	2.0	3.0	2.8
COD	"	138	0.8	31.6	20	26	12	18	18	38	11	25.6	27
Sulphates	"	72	45	63.6	66	92	69	77	77	82	52	68.4	68
Chlorides	"	-	-	-	-	37	30	34	35	42	26	33.7	32
MBAS	"	-	-	-	-	.24	.09	.13	.12	0.20	0.08	0.13	0.13
NH_3-N	"	0.33	0.06	0.20	0.21	0.67	0.10	0.27	0.28	0.41	0.01	0.18	0.18
NO_2+NO_3-N	"	0.60	0.12	0.30	0.26	0.67	0.10	0.37	0.34	0.63	0.01	0.23	0.21
Org. N	"	0.83	0.44	0.58	0.55	1.11	0.35	0.70	0.62	1.05	0.28	0.69	0.74
Sol PO_4	"	0.24	0.02	0.09	0.05	0.24	0.00	0.03	0.02	0.11	0.03	0.07	0.07
Total PO_4	"	0.49	0.05	0.13	0.08	0.27	0.03	0.07	0.06	0.15	0.06	0.09	0.09
Iron	"	0.37	0.04	0.20	0.22	0.77	0.05	0.23	0.23	0.27	0.04	0.15	0.15
Cyanide	"	None found				0.02	0.00	0.002	0.00	0.01	0.00	0.00	0.00
Sus. Solids	"	24	2	13	15	65	2	25	24	58	3	16.2	14
Dis. Solids	"	305	245	281	280	315	220	289	295	343	172	258	260
Phenol	ug/l	8	0	3.6	3	15	1.4	6.8	8.0	20.0	1.0	5.4	3.5
		Data based on 11 samples				Data based on 26 samples				Data based on 26 samples			

In the lake outlet stream at Station 10, concentrations of DO, BOD, COD, ammonia, and phosphates were lower than in the lake - probably due to stabilization reactions in the lake and the stream.

Both the phenols and the sulphates were consistently higher in the outlet than in the lake. The reason for this is not understood since there is no known source of waste between the two stations. The microbiological quality of the water at Station 10 was good but the total coliforms increased since 1965. Further investigations of these findings are planned.


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 11, 12 & 13
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
Calumet Harbor
Lake Michigan
STA. 13 – CALUMET HARBOR (CR 334.0)
STA. 11 – CALUMET HARBOR MONITOR (CR 333.45)
STA. 12 – CALUMET RIVER MOUTH (CR 333.4)
Lake Calumet
Calumet River
WHITING
Wolf Lake
Harbor Can.
EAST CHICAGO
Indiana
Grand
Calumet
River
Little
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet
River

Stations 11, 12 and 13 - Calumet Harbor

There are three sampling stations located at Calumet Harbor. Station 11 is located at the mouth of the Grand Calumet River immediately adjacent to the north pierhead light. The purpose of this station is to correlate the sampling program with a water quality monitor which is located in the pierhead light structure.

Station 12 is located at the mouth of the Grand Calumet River at midstream. The purpose of this station is to monitor the quality of the water entering the river from the harbor.

Station 13 is located in mid-harbor approximately 3500 feet from the mouth of the river. This station monitors the quality of the water flowing in from Lake Michigan to the river. Stations 12 and 13 require a boat for sampling and therefore can be sampled only when weather permits.

Operation of the O'Brien Lock tends to isolate the area by reversing the natural flow of the river, so that water flows from the lake to the river most of the time. For this reason most of the pollution in the harbor and at the river mouth originates in the immediate area.

The graphs on pages 48, 49 and 50 show that the level of microbiological pollution was slightly less than in 1965. The higher counts in the last half of 1966 were due to the higher temperatures during the period. This area was not designated as a control point by the Technical Committee but the criteria for inner harbor basins could reasonably be applied.

The criteria for total coliform (maximum 5000 per 100 ml and average 2000 per 100 ml) were generally met at all three stations.

The criterion for fecal streptococci (maximum 100 per 100 ml) was not met approximately one third of the time at each station. High fecal coliform counts also occurred. On several occasions there were high fecal coliform to total coliform ratios. This indicates that the pollution is fresh, of animal origin and local in nature. A large number of ships and boats use the harbor.

Since flow is usually from the harbor to the river, industrial pollution in the harbor is not severe. At Station 13, which is out in the harbor, all of the chemical criteria except pH and ammonia nitrogen were met.

The criteria for phosphates and iron were not met at the two stations in the river mouth; as Table 11 on page 51 indicates, there were high concentrations of iron at Station 11. Iron from U. S. Steel outfalls to the harbor often discolored the entire area. This also created high turbidity. A comparison of the 1965 data with the July-December 1966 data reveals no significant changes except that ammonia nitrogen concentrations were higher in 1966 and phosphate concentrations were lower.

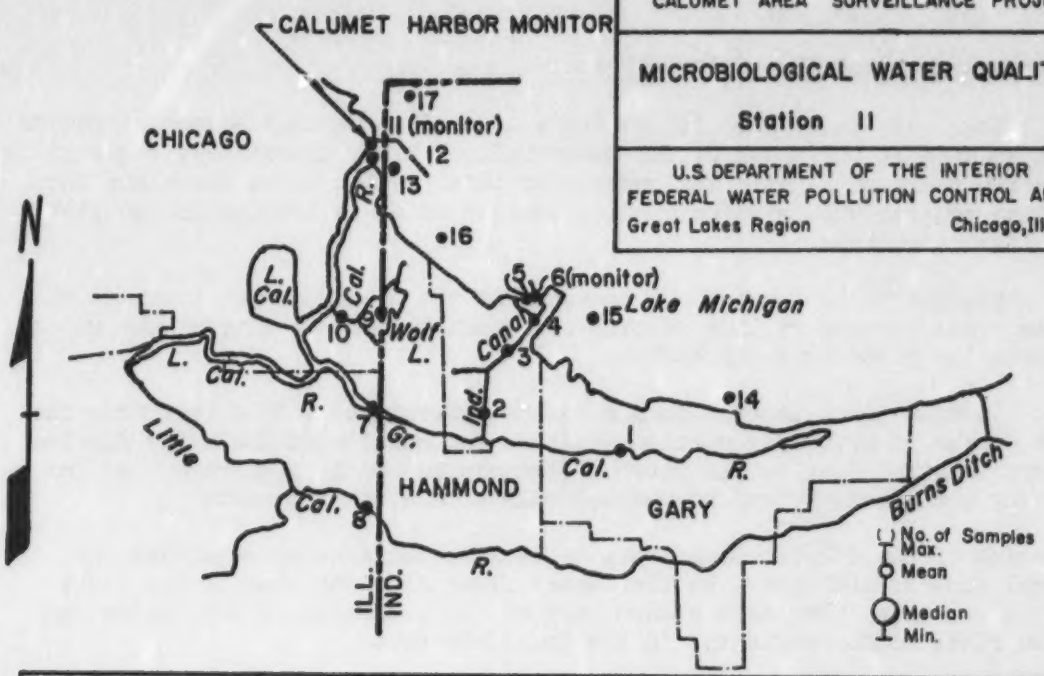
Except for the severe discoloration of the water around Station 11 by iron, pollution is less severe in Calumet Harbor than in Indiana Harbor.

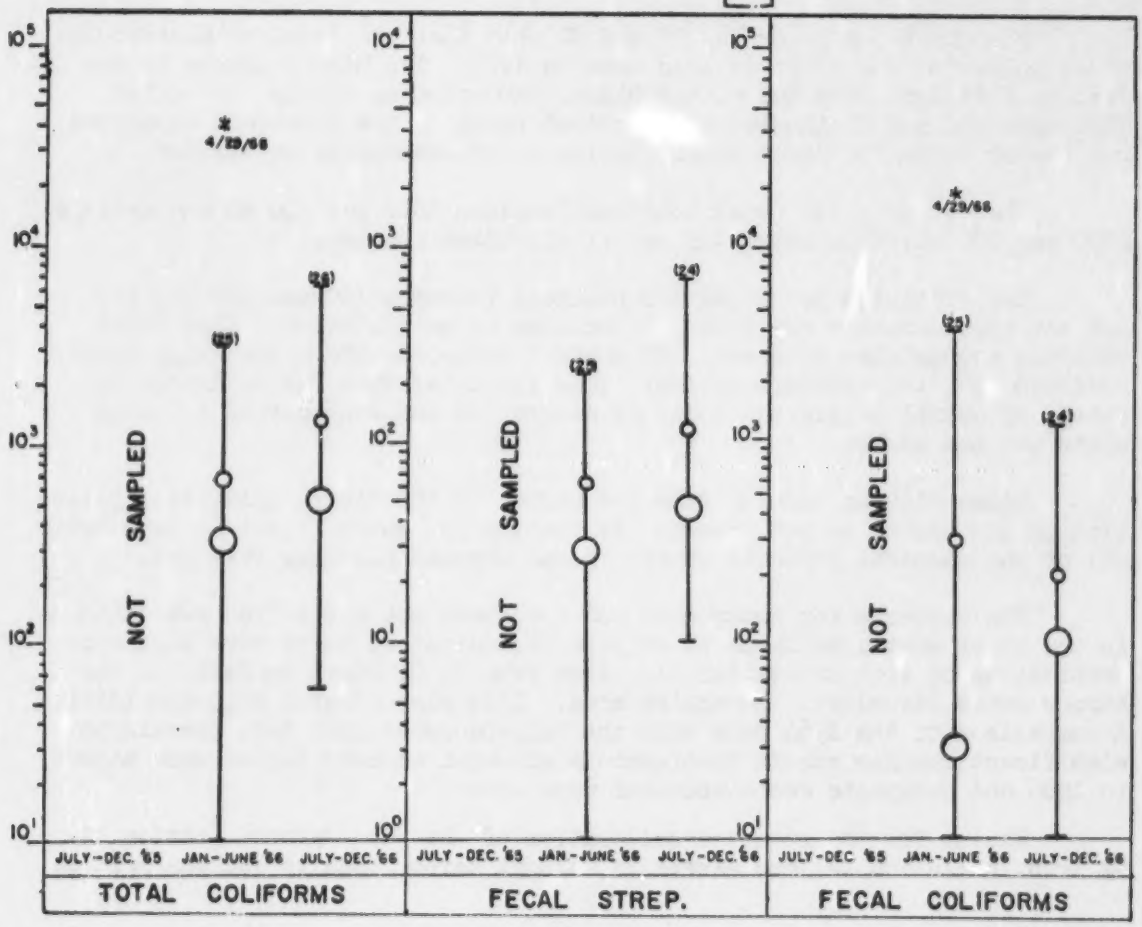
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 11

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region — Chicago, Illinois





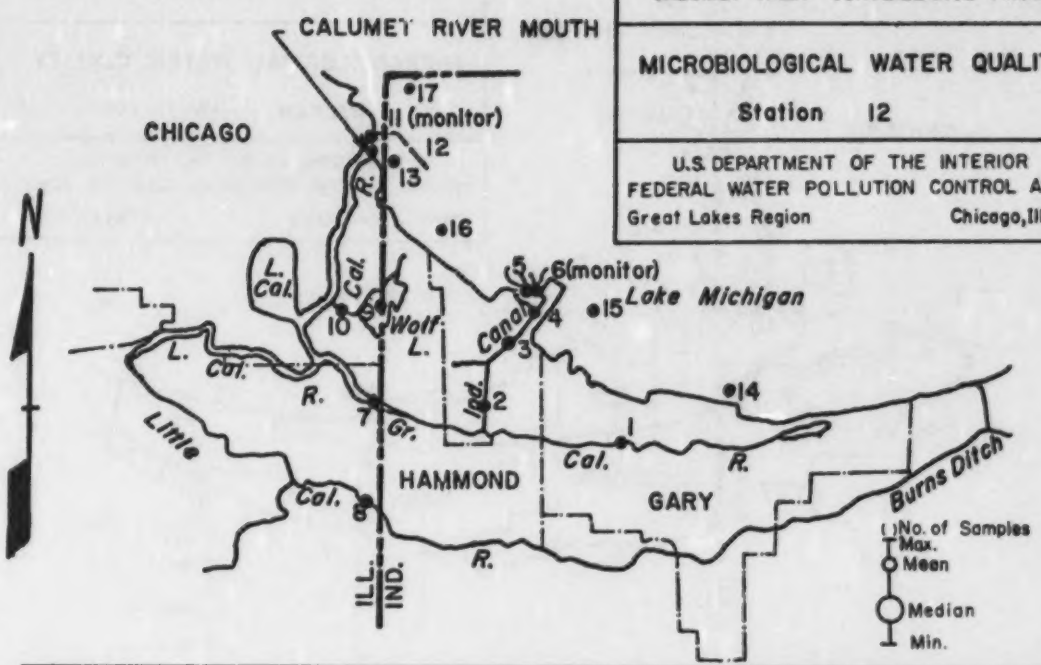
GPO 802-902-9

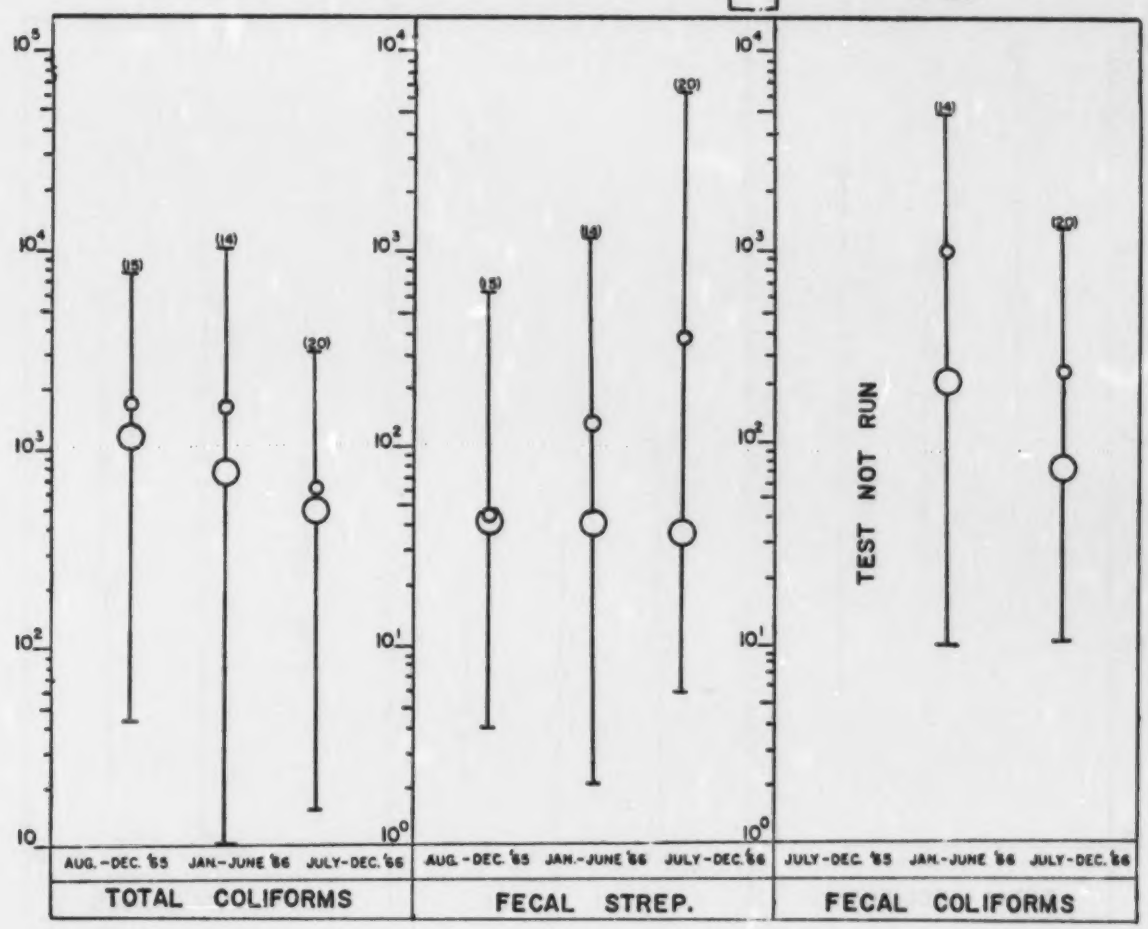
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 12

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region — Chicago, Illinois



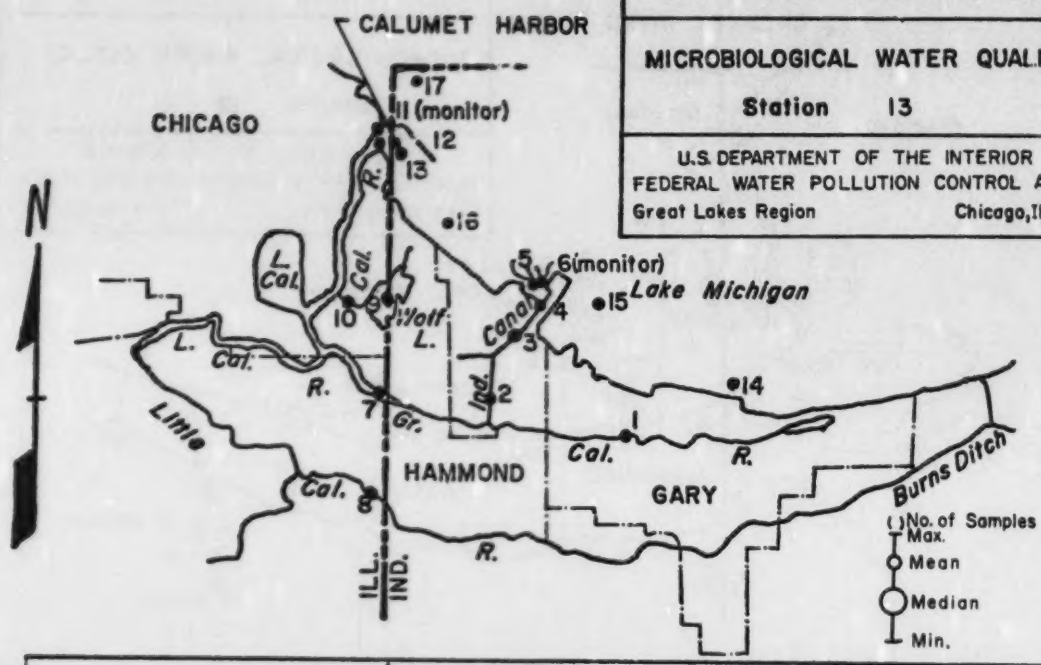


CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 13

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois



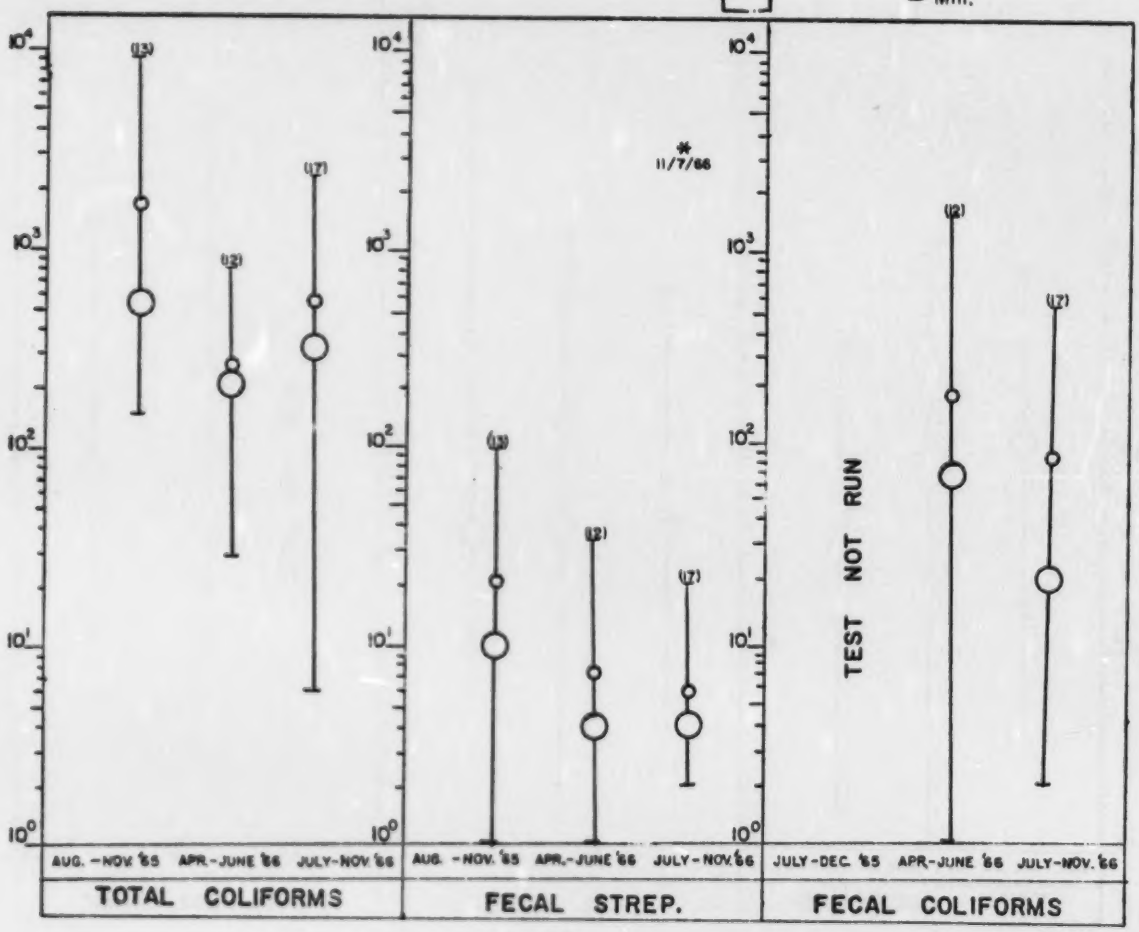


TABLE 11

CHEMICAL QUALITY OF WATER

STATION 11 - CALUMET RIVER AT NORTH PIERHEAD LIGHT-CR 333.45
(WATER QUALITY MONITORING STATION)

Parameter		July 1965-Dec. 1965 Max	Min	Mean	Median	Jan. 1966-June 1966 Max	Min	Mean	Median	July 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C					19	0	7	6	26	1	15.3	15
pH						8.3	7.4	-	7.8	8.1	7.3	-	7.9
Conductivity	umho/cm					330	203	298	300	410	250	313	300
Alkalinity	mg/l					-	-	-	-	133	88	106	106
DO	"					14.1	4.2	10.1	10.4	12.65	4.85	8.10	7.70
BOD	"					4.9	0.9	2.5	2.2	5.6	1.1	2.6	2.5
COD	"					36	0.7	9.5	8.8	42	5	16	15
Sulphates	"					35	21	27	27	38	16	26.4	28
Chlorides	"	NOT SAMPLED IN 1965				16	10	12	12	25	9	11.8	10
MBAS	"					.22	.03	.07	.05	0.14	0.02	0.08	0.08
NH_3-N	"					0.72	0.21	0.49	0.46	1.10	0.12	0.35	0.29
NO_2+NO_3-N	"					0.32	0.09	0.20	0.22	.70	.09	.24	.19
Org. N	"					0.70	0.05	0.34	0.31	0.64	0.03	0.31	0.29
Sol PO_4	"					0.78	0.00	0.11	0.04	0.79	0.01	0.07	0.04
Total PO_4	"					0.90	0.04	0.17	0.09	1.10	0.04	0.18	0.10
Iron	"					8.6	0.09	2.1	1.1	97.00	.69	13.2	2.1
Cyanide	"					0.13	0.00	0.02	0.01	0.02	0.00	0.00	0.00
Sus. Solids	"					85	8	29	23	191	3	41	20
Dis. Solids	"					210	160	182	185	211	80	172	177
Phenol	ug/l					15	0.6	2.9	2.7	19.0	0.0	4.0	2
Turbidity	units					-	-	-	-	90.0	.6	35.0	12.5
						Data based on 25 samples				Data based on 26 samples			

TABLE 12

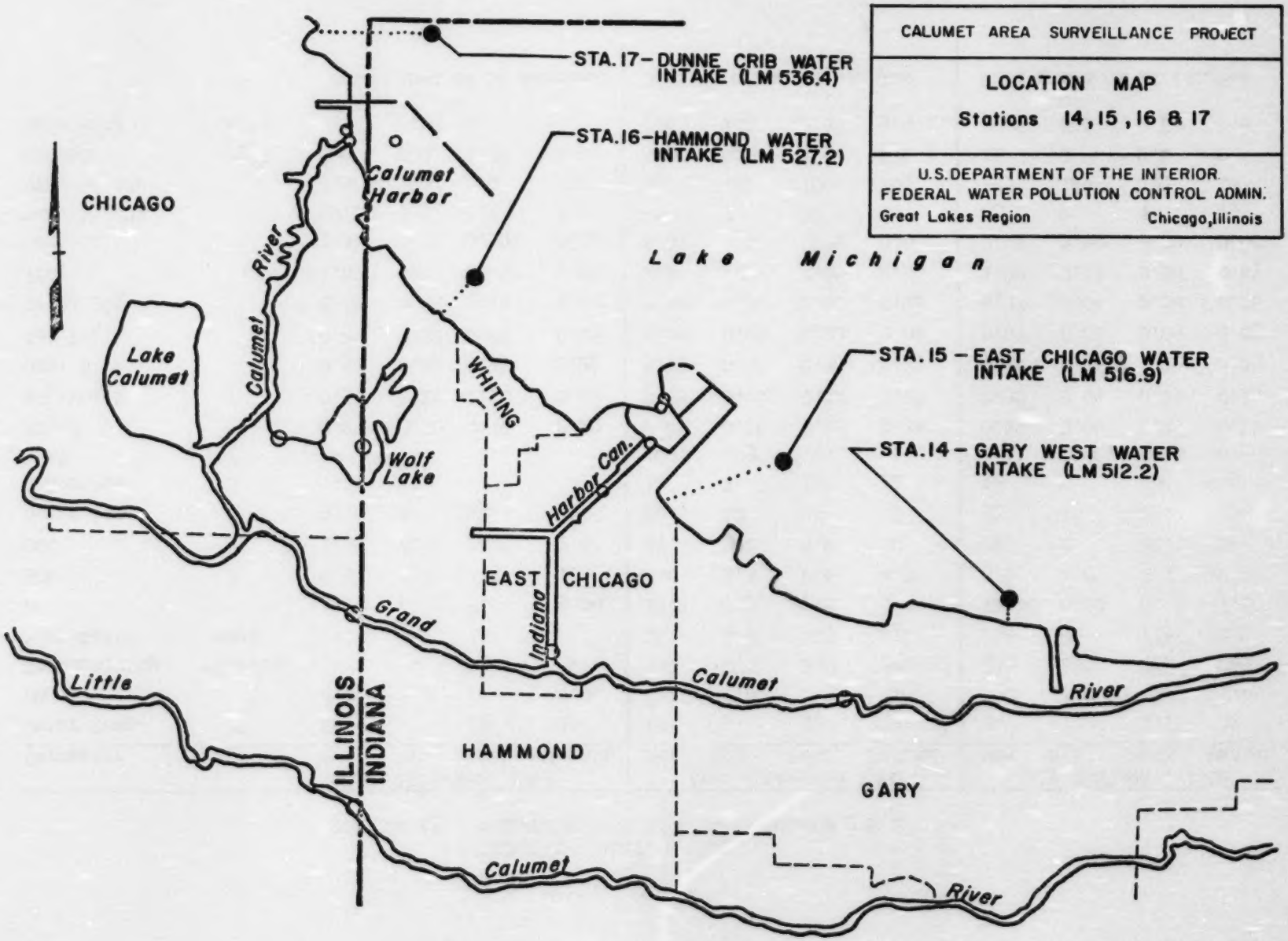
CHEMICAL QUALITY OF WATER
STATION 12 - CALUMET RIVER AT MOUTH - PIERHEAD LIGHTS-CR 333.4

Parameter		Aug. 1965-Dec. 1965 Max	Min	Mean	Median	Jan. 1966-June 1966 Max	Min	Mean	Median	July 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	22	3	13.6	14	19	4	11	11	24	2	17.7	21
pH		8.0	7.5	-	7.9	8.1	7.5	-	7.9	8.0	7.2	-	7.8
Conductivity	umho/cm	-	-	-	-	330	285	300	295	330	285	304	300
Alkalinity	mg/l	-	-	-	-	117	110	113	113	211	93	113	109
DO	"	6.78	13.00	8.80	8.50	11.1	5.40	8.46	7.85	12.40	1.60	7.55	7.30
BOD	"	3.7	1.0	1.92	2.2	5.5	1.0	2.8	2.2	28	0.4	3.87	2.1
COD	"	120	0.9	28.7	12	18	1.6	10.4	10	39	12	14.4	6
Sulphates	"	26	17	23	23	30	18	25	25	32	16	24.2	25
Chlorides	"	-	-	-	-	16	9	12	12	18	9	10.7	10
MBAS	"	-	-	-	-	.10	.03	.06	.05	0.12	0.03	0.07	0.07
NH_3-N	"	0.39	0.15	0.20	0.22	0.68	0.35	0.50	0.50	0.55	0.08	0.30	0.31
NO_2+NO_3-N	"	0.41	0.17	0.23	0.27	0.35	0.09	0.20	0.21	0.50	0.09	0.27	0.26
Org. N	"	0.60	0.04	0.24	0.29	3.23	0.07	0.56	0.33	0.52	0.01	0.27	0.28
Sol PO_4	"	0.23	0.02	0.07	0.07	0.09	0.01	0.04	0.04	0.05	0.01	0.04	0.04
Total PO_4	"	0.25	0.02	0.11	0.09	0.13	0.05	0.08	0.08	0.23	0.04	0.09	0.07
Iron	"	2.30	0.24	0.84	0.72	1.8	0.55	1.10	1.10	7.1	0.44	1.72	1.2
Cyanide	"	0.01	0.00	0.00	0.00	0.12	0.00	0.01	0.01	0.01	0.00	0.00	0.00
Sus. Solids	"	76	2.0	19.6	18	53	4	20	17	88	6	21.8	12
Dis. Solids	"	280	140	180	170	235	175	192	185	200	155	179	170
Phenol	ug/l	8.2	0.00	2.31	2.0	12	0.0	1.9	0.6	5	0	2.1	2
		Data based on 15 samples				Data based on 13 samples				Data based on 20 samples			

TABLE 13

CHEMICAL QUALITY OF WATER
STATION 13 - CALUMET HARBOR AT MID-CHANNEL-CR 334.0

Parameter		Aug. 1965-Nov. 1965 Max	Min	Mean	Median	Apr. 1966-June 1966 Max	Min	Mean	Median	July 1966-Nov. 1966 Max	Min	Mean	Median
Water Temp.	°C	22	7	15	15	18	5	12	14	24	7	19.1	22
pH		8.0	7.7	-	7.9	8.1	7.4	-	7.8	8.0	7.6	-	7.8
Conductivity	umho/cm	-	-	-	-	310	270	293	300	315	275	298	295
Alkalinity	mg/l	-	-	-	-	121	107	113	111	212	96	115	111
DO	"	11.0	6.95	8.84	9.00	12.2	7.3	9.2	9.3	11.40	6.20	8.11	7.65
BOD	"	2.1	1.0	1.5	1.6	4.8	1.3	2.6	2.3	3.4	1.0	2.1	2.0
COD	"	120	0.0	18.6	7.6	16	3.0	9.2	10	22	2	12.7	14
Sulphates	"	37.0	19	24.8	24	26	18	24	25	33	16	23.7	25
Chlorides	"	-	-	-	-	14	8	11	11	12	9	10	10
MBAS	"	-	-	-	-	.09	.03	.05	.04	0.11	0.02	0.06	0.06
NH_3-N	"	0.27	0.10	0.19	0.20	0.48	0.24	0.33	0.33	0.47	0.04	0.25	0.24
NO_2+NO_3-N	"	0.53	0.17	0.26	0.24	0.35	0.08	0.18	0.16	0.38	0.04	0.19	0.19
Org. N	"	0.51	0.03	0.25	0.22	0.56	0.10	0.37	0.39	0.37	0.06	0.22	0.23
Sol PO_4	"	0.29	0.02	0.07	0.05	0.05	0.00	0.02	0.02	0.07	0.01	0.03	0.03
Total PO_4	"	0.78	0.02	0.14	0.09	0.10	0.04	0.06	0.06	0.08	0.04	0.06	0.06
Iron	"	1.82	0.09	0.46	0.21	2.1	0.29	0.66	0.48	1.80	0.12	0.50	0.47
Cyanide	"	0.01	0.0	0.001	0.00	0.01	0.00	.002	0.00	0.01	0.00	0.00	0.00
Sus. Solids	"	19.0	1.0	9.3	8.0	46	3	12	9	23	2	9	7
Dis. Solids	"	195	150	170	170	210	170	190	185	185	126	167	167
Phenol	ug/l	8.0	0.0	1.35	0.9	5.3	0.0	1.3	0.0	11	0	2.4	2
Turbidity	units	-	-	-	-	8.8	1.3	2.6	3.4	19.9	0.6	2.8	1.6
		Data based on 12 samples				Data based on 12 samples				Data based on 17 samples			


CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
Stations 14, 15, 16 & 17
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
STA. 17 – DUNNE CRIB WATER INTAKE (LM 536.4)
STA. 16 – HAMMOND WATER INTAKE (LM 527.2)
STA. 15 – EAST CHICAGO WATER INTAKE (LM 516.9)
STA. 14 – GARY WEST WATER INTAKE (LM 512.2)
CHICAGO
Calumet Harbor
Lake Michigan
Calumet River
Lake Calumet
Wolf Lake
WHITING
Harbor Can.
EAST CHICAGO
Indiana
Grand
Calumet
River
Little
ILLINOIS
INDIANA
HAMMOND
GARY
Calumet
River

Station 14 - Gary West Water Intake

The Gary West water intake is one of the control points designated by the Calumet Area Technical Committee for open Lake Michigan water. It was originally intended that the water filtration plant at which the samples are collected should perform the analyses at the raw water intakes. It became evident that these plants did not have the capacity for this undertaking and therefore the Calumet Area Post Action Surveillance Project began sampling these points during August 1966 in order to determine whether or not the recommended criteria are being met.

The recommended criteria for microbiological parameters have been plotted on the graph "Microbiological Water Quality Station 14", page 56. The maximum for total coliforms was not exceeded but the average of 258 per 100 ml was higher than the criteria permit (200 per 100 ml). The criteria for fecal streptococci were met on all but one occasion.

Table 14 compares the recommended criteria for other parameters with the results of the sampling program. The criteria for water temperature, dissolved oxygen, sulphates, chlorides, MBAS, cyanide and fluorides were met.

The water at this point had a pH which was considerably below the range of the criteria. The water was of a high quality and the intake is remote from major sources of pollution so that it should reflect the basic characteristics of "natural" lake waters. The low alkalinity at this point indicates that the recommended range of pH recommended by the criteria cannot be met. It is believed the pH criteria should be reviewed for possible revision.

The results indicate that there was considerably more ammonia nitrogen and total nitrogen present than the tentatively recommended criteria permit. This was also true at Wolf Lake which is another high quality body of water. Ammonia in water is commonly regarded as an indication of local pollution since it is reduced to nitrate and nitrite nitrogen in a relatively short time. But Gary West water intake is too remote from man-made pollution for this to be the cause. It is believed that the Gary water intake - as well as Chicago's Dunne Crib intake, to be discussed later - normally receive water whose quality is essentially that of the main body of southern Lake Michigan. This in no way alleviates the problem created at water supply intakes when adverse wind and current conditions bring periodic slugs of water containing high concentrations of ammonia nitrogen. It is understood that the Calumet Area Technical Committee is presenting a report which will help to clarify the ammonia nitrogen picture.

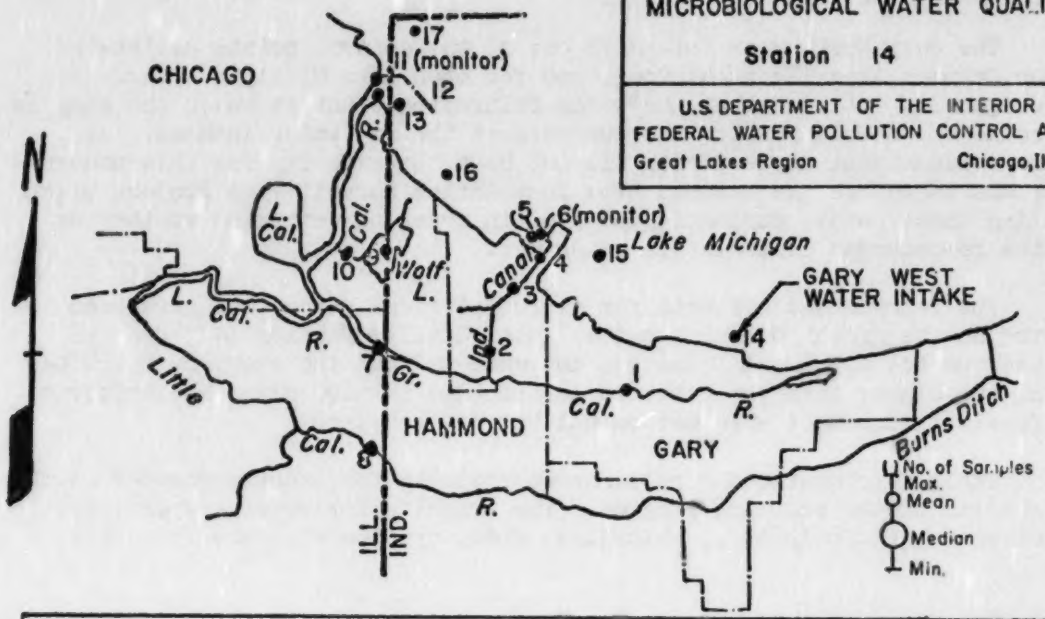
There is also considerably more total phosphate than the tentatively recommended criteria permit. The mean concentration of 0.073 mg/l is approximately 2.5 times the tentative criterion of 0.03 mg/l. Data for the four water intake stations reveals that the maximums are usually twice or several times the means.

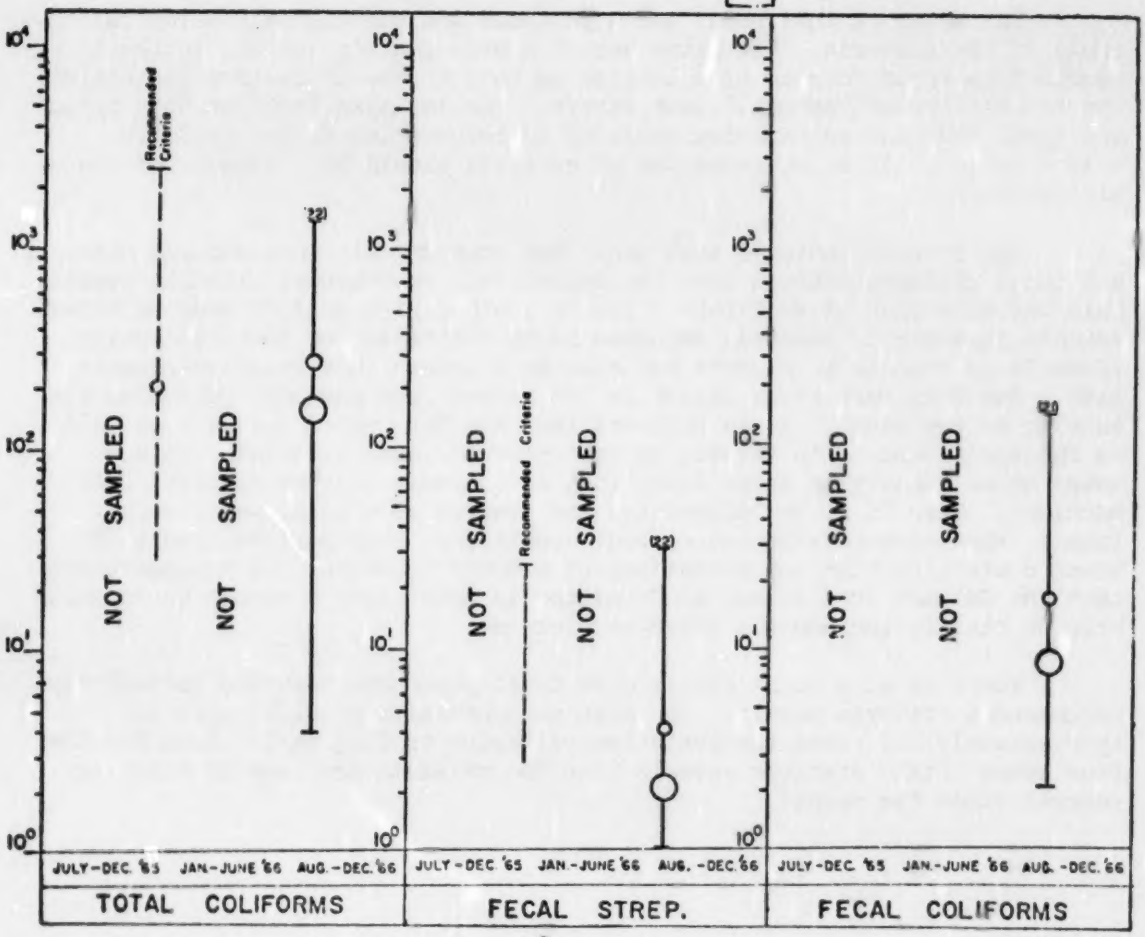
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 14

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois





GPO 802-302-4

TABLE 14

CHEMICAL QUALITY OF WATER
STATION 14 - GARY WEST WATER FILTRATION INTAKE-LM 512.2

Parameter		Recommended Criteria Max	Min	Mean	Median	Aug. 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	29.4				22	1	13.1	13
pH		9.0	7.7		8.1-8.4	8.1	7.1	-	7.7
Conductivity	umho/cm	-	-	-	-	325	260	295	295
Alkalinity	mg/l	-	-	-	-	113	90	103.7	107
DO	"	-	80% sat.	90% sat:	-	14.80	4.9	9.55	9.60
BOD	"	-	-	-	-	2.0	0.1	1.4	1.3
COD	"	-	-	-	-	21	2	10.5	10
Sulphates	"	50		23		37	16	22.9	21
Chlorides	"	15		8		11	8	9.6	10
MBAS	"	0.20		0.05		0.13	0.02	0.06	0.05
NH_3-N)	"	0.05*		0.02*		0.28	0.01	.07	0.06
NO_2+NO_3-N)tot.N	"	0.4*				0.54	0.05	0.24	0.22
Org. N)	"					0.46	0.01	0.21	0.21
Sol PO_4	"	-	-	-	-	.05	.01	.035	0.04
Total PO_4	"	0.04*		0.03*		0.24	0.02	.073	0.05
Iron	"	0.30		0.15		3.9	0.05	0.63	0.44
Cyanide	"	0.025				0.01	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	149	3	21.5	9
Dis. Solids	"	200		162		215	112	168	170
Fluorides	"	1.3		1.0		0.40	0.12	0.21	0.20
Oil & Grease	"	Free from floating oil				4.8	0.0	1.0	0.5
Phenol	ug/l	3.0*		1.0*		5.0	0.00	1.45	1.0
Turbidity	units	No contrast with natural appearance				49	.6	9.7	2.0
Color	"	15		5		20	0	4.45	5.0
Threshold Odor	"	8		4		60	1.5	5.86	2.5

*tentative

Data based on 22 samples

A severe storm occurred on November 29, 1966. The effect of such a storm on the quality of the water in the lake can be assessed from the results of the November 30, 1966 sampling run. Many of the maximums at this and other water intake stations occurred on this date. Suspended solids and turbidity were very high in comparison to their normal levels. The other maximums give an indication of the composition of the bottom muds which were undoubtedly stirred up. These were organic nitrogen, total phosphate, soluble phosphate and total iron. It is interesting to note that on this date no phenols were found at any of the water intake stations.

Station 15 - East Chicago Water Intake

The East Chicago Water Intake is one of the control points designated by the Calumet Area Technical Committee for inner harbor basins. This intake is located just east of Indiana Harbor and can be severely affected by pollutants from the harbor when the wind is from a westerly direction.

The recommended criteria for inner harbor basins are compared with the actual water quality on pages 59 and 61 . The criteria for water temperature, dissolved oxygen, sulphates, chlorides, MBAS, dissolved solids and fluorides were met during July-December 1966.

The pH of the water was outside the range of the criteria; being considerably lower than the minimum limit set (see previous discussion of pH criteria). A similar situation exists at all four water intake stations.

This station was most severely affected by the storm that took place on November 29, 1966. November 30, 1966 was one of the two days on which the criteria for total coliforms was not met. The fecal streptococci count was 540 per 100 ml, much higher than the next highest count of 100 per 100 ml, which occurred during the next week. The normal fecal streptococci count at this station was less than 5 per 100 ml. This suggests that the lake bottom in this area contained a considerable amount of man-made sediment. Many of the maximums at this station were a result of the storm. Concentration of BOD, COD, organic nitrogen, total phosphate, total iron, turbidity, and suspended solids were highest on November 30. Total iron, turbidity and suspended solids were far above their normal levels and the data for subsequent weeks indicate that the lake did not return to normal for more than a month. This indicates that there is a considerable "bank" of material at the bottom of the lake which can be stirred up by violent weather.

Station 16 - Hammond Water Intake

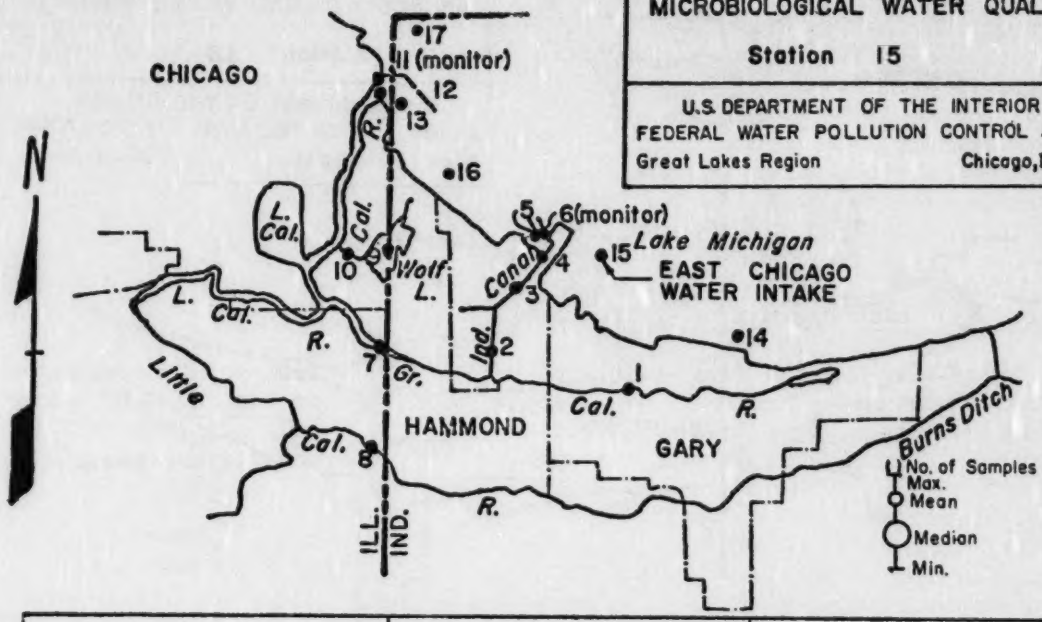
The Hammond water intake is the other control point designated by the Calumet Area Technical Committee for inner harbor basins. This intake is located west of Indiana Harbor and is often affected by wastes from the harbor, especially when the wind is from the south or the east.

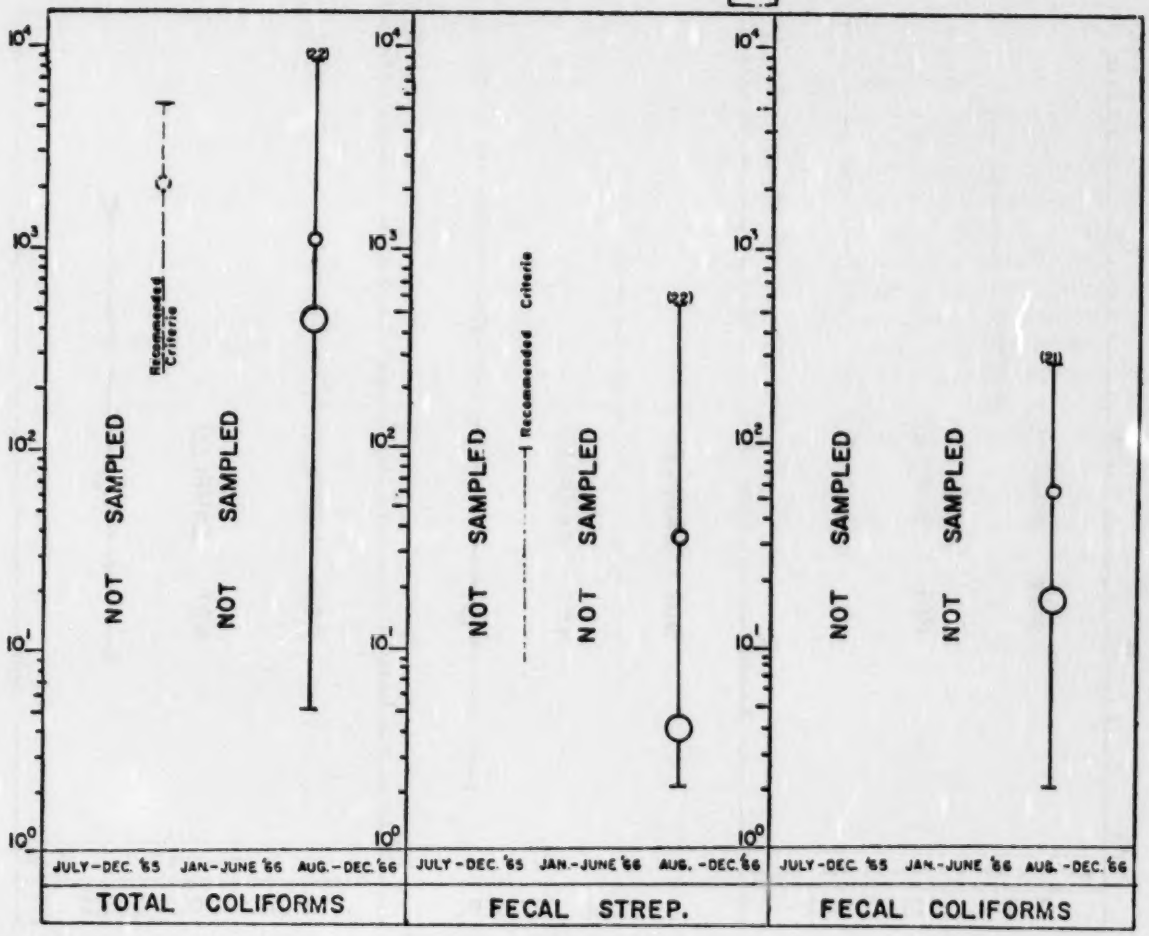
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 15

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois





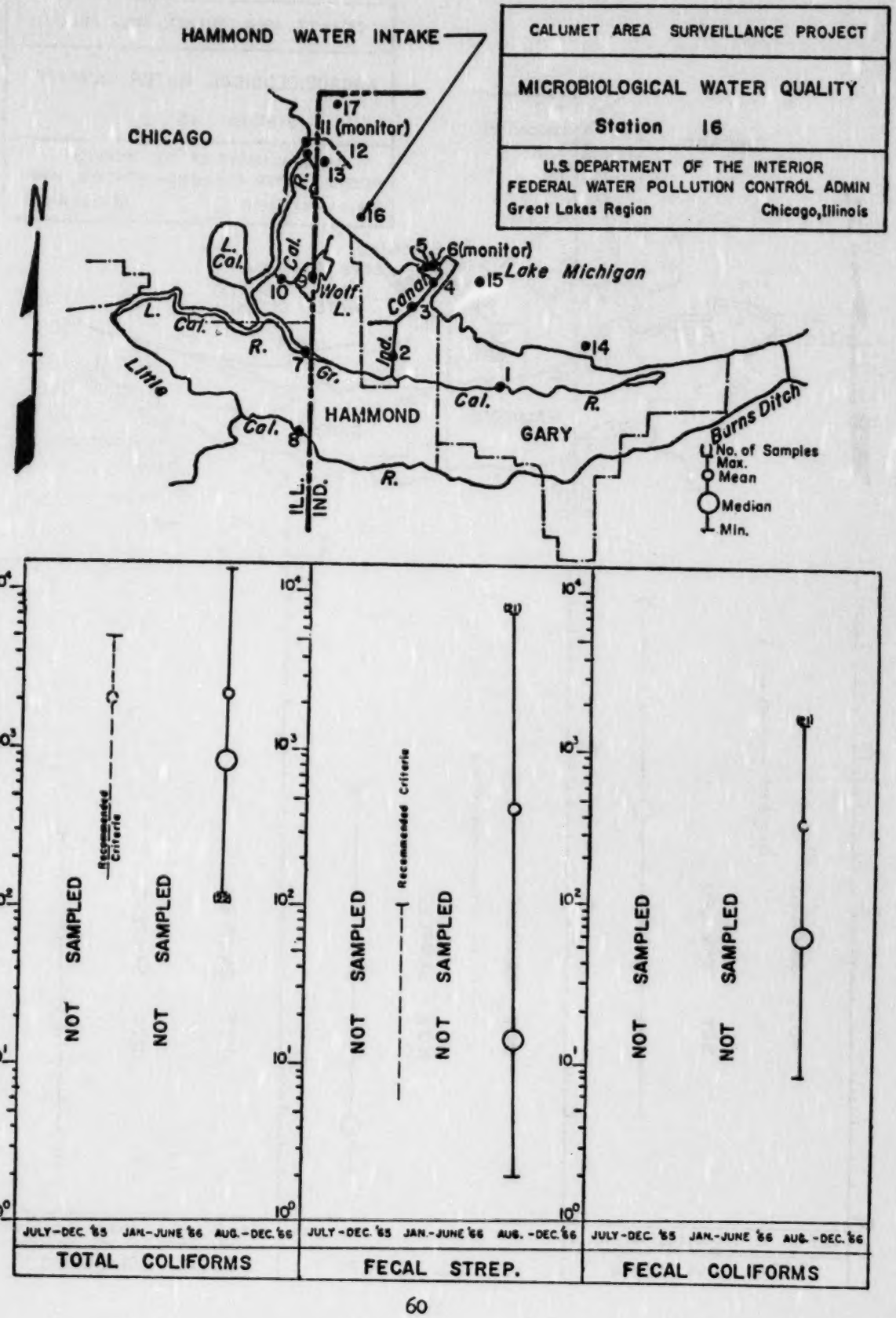

CALUMET AREA SURVEILLANCE PROJECT
MICROBIOLOGICAL WATER QUALITY
Station 16
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region
Chicago, Illinois
HAMMOND WATER INTAKE
CHICAGO
17
11 (monitor)
12
13
16
6(monitor)
15
Lake Michigan
14
HAMMOND
GARY
Burns Ditch
L. Cal.
Cal. R.
Wolf L.
Canal
Ind.
Gr.
Little Cal.
R.
ILL.
IND.
N
No. of Samples
Max.
Mean
Median
Min.
NOT SAMPLED
Recommended Criteria
JULY-DEC. '65
JAN.-JUNE '66
AUG.-DEC. '66
TOTAL COLIFORMS
FECAL STREP.
FECAL COLIFORMS

TABLE 15

CHEMICAL QUALITY OF WATER
STATION 15 - EAST CHICAGO WATER FILTRATION INTAKE-LM 516.9

Parameter		Recommended Criteria Max	Min	Mean	Median	Aug. 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	29.4				21	0	12.6	13
pH		9.0	7.5		8.0-8.5	8.1	7.4	-	7.7
Conductivity	umho/cm	-	-	-	-	360	275	307	300
Alkalinity	mg/l	-	-	-	-	132	86	103	105
DO	"	-	65% sat.	80% sat.	-	17.05	8.30	12.69	13.00
BOD	"	-	-	-	-	5.5	0.2	1.62	1.6
COD	"	-	-	-	-	62	3	13	11
Sulphates	"	75		35		36	16	24.9	24
Chlorides	"	30		16		13	8	10	10
MBAS	"	0.30		0.10		0.13	0.04	0.07	0.06
NH_3-N	"	0.12*		0.05*		0.40	0.02	0.14	0.14
NO_2+NO_3-N	"	-	-	-	-	0.60	0.00	0.25	0.27
Org. N	"	-	-	-	-	1.19	0.05	0.29	0.21
Sol PO_4	"	-	-	-	-	0.07	0.01	0.04	0.04
Total PO_4	"	0.10*		0.05*		1.00	0.03	0.12	0.06
Iron	"	0.30		0.15		22	0.05	1.48	0.35
Cyanide	"	0.1				0.2	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	464	2	37	12
Dis. Solids	"	230		187		211	77	164	165
Fluorides	"	1.3		1.0		0.28	0.14	0.20	0.19
Oil & Grease	"	Free from floating oil				4.2	0.0	0.9	0.5
Phenol	ug/l	5.0*		2.0*		7	0	1.5	1
Turbidity	units	No contrast with natural appearance				160	0.6	15	2.0
Color	"	15		5		50	0	7.9	5.0
Threshold Odor	"	20*		8*		100	1.5	14.7	5

*tentative

Data based on 22 samples

TABLE 16

CHEMICAL QUALITY OF WATER
STATION 16 - HAMMOND WATER FILTRATION INTAKE-LM 527.2

Parameter		Recommended Criteria Max	Min	Mean	Median	Aug. 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	29.4				22	0	13.0	13
pH		9.0	7.5		8.0-8.5	7.9	7.2	-	7.7
Conductivity	umho/cm	-	-	-	-	320	275	303	300
Alkalinity	mg/l	-	-	-	-	119	88	102.7	103
DO	"	-	65% sat.	80% sat.	-	13.35	5.70	9.48	9.30
BOD	"	-	-	-	-	3.6	0.9	1.72	1.6
COD	"	-	-	-	-	32	4	13.4	12
Sulphates	"	75		35		38	13	24.9	25
Chlorides	"	30		16		13	9	10.3	10
MBAS	"	0.30		0.10		0.12	0.03	0.07	0.07
NH_3-N	"	0.12*		0.05*		0.38	0.04	0.18	0.16
NO_2+NO_3-N	"	-	-	-	-	0.76	0.05	0.32	0.26
Org. N	"	-	-	-	-	0.73	0.06	0.29	0.26
Sol PO_4	"	-	-	-	-	0.06	0.01	0.04	0.04
Total PO_4	"	0.10*		0.05*		0.32	0.03	0.10	0.07
Iron	"	0.30		0.15		5.9	0.04	0.85	0.52
Cyanide	"	0.1				0.01	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	202	2	30.6	13
Dis. Solids	"	230		187		275	87	167	170
Fluorides	"	1.3		1.0		0.24	0.16	0.20	0.20
Oil & Grease	"	Free from floating oil				5.4	0.0	0.8	0.4
Phenol	ug/l	5.0*		2.0*		6	0	2.1	2
Turbidity	units	No contrast with natural appearance				180	0.6	17.6	2.8
Color	"	15		5		15	0	4.6	4
Threshold Odor	"	20*		8*		150	3.5	34	16

*tentative

Data based on 22 samples

This is the only water intake station where the microbiological criteria were seriously violated. The total coliform count was considerably above the maximum of 5000 per 100 ml on two occasions and the fecal streptococci count was above 100 per 100 ml on three occasions.

The criteria for water temperature, dissolved oxygen, sulphates, chlorides, MBAS, cyanide, fluorides and color were met. As at the other water intake stations the criteria for pH and ammonia were not met. The criteria for total phosphate, iron, dissolved solids, phenols and threshold odor were not met.

The affect of a major storm stirring up the lake bottom is reflected by the data for November 30, 1966. Organic nitrogen, total phosphate, total iron, turbidity and suspended solids were all highest on this date.

Station 17 - Dunne Crib Water Intake

The Dunne Crib water intake, which supplies lake water to the city of Chicago's South District Water Filtration Plant, is the second control point designated by the Calumet Area Technical Committee for open lake water. This intake is well isolated from man-made sources of pollution. Its location outside of the Calumet Harbor breakwater shields it from pollution originating in Indiana Harbor. The water quality at this point is better than it is at any of the other water intake stations.

The criteria for water temperature, dissolved oxygen, sulphates, chlorides, MBAS, cyanide, dissolved solids, fluorides, phenol and color were met at this station. The criteria for pH, ammonia nitrogen and threshold odor were not met.

The criteria for total phosphate and total iron were met except during and after the storm that took place on November 29, 1966. Before this storm the levels of both parameters were low enough to satisfy the criteria.

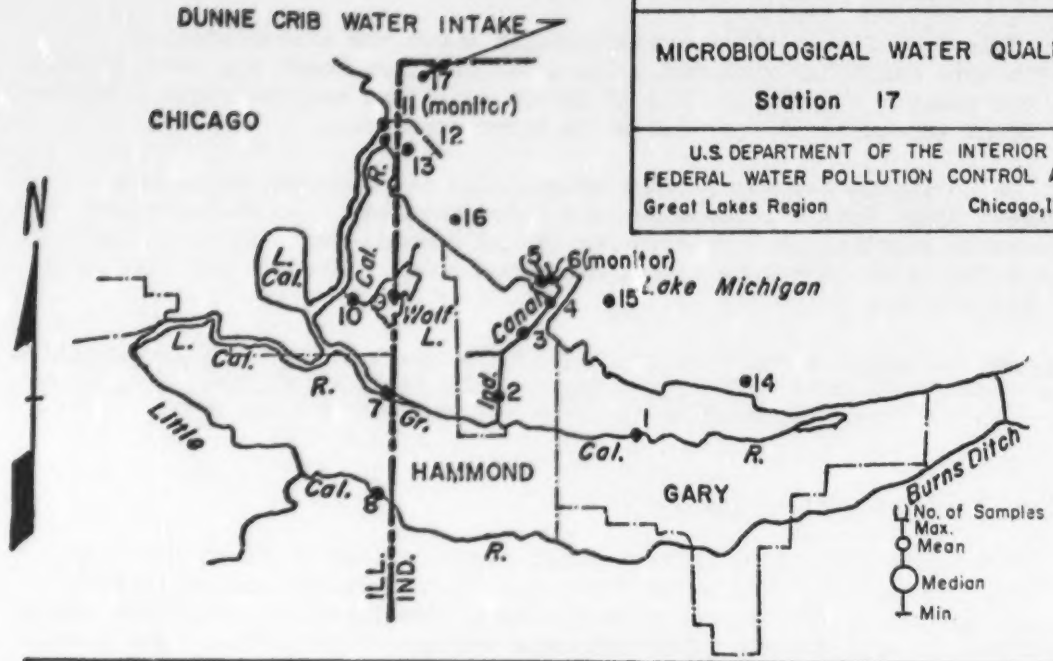
The microbiological quality of the water was very good. The counts for total coliform and fecal streptococci were well within the recommended criteria.

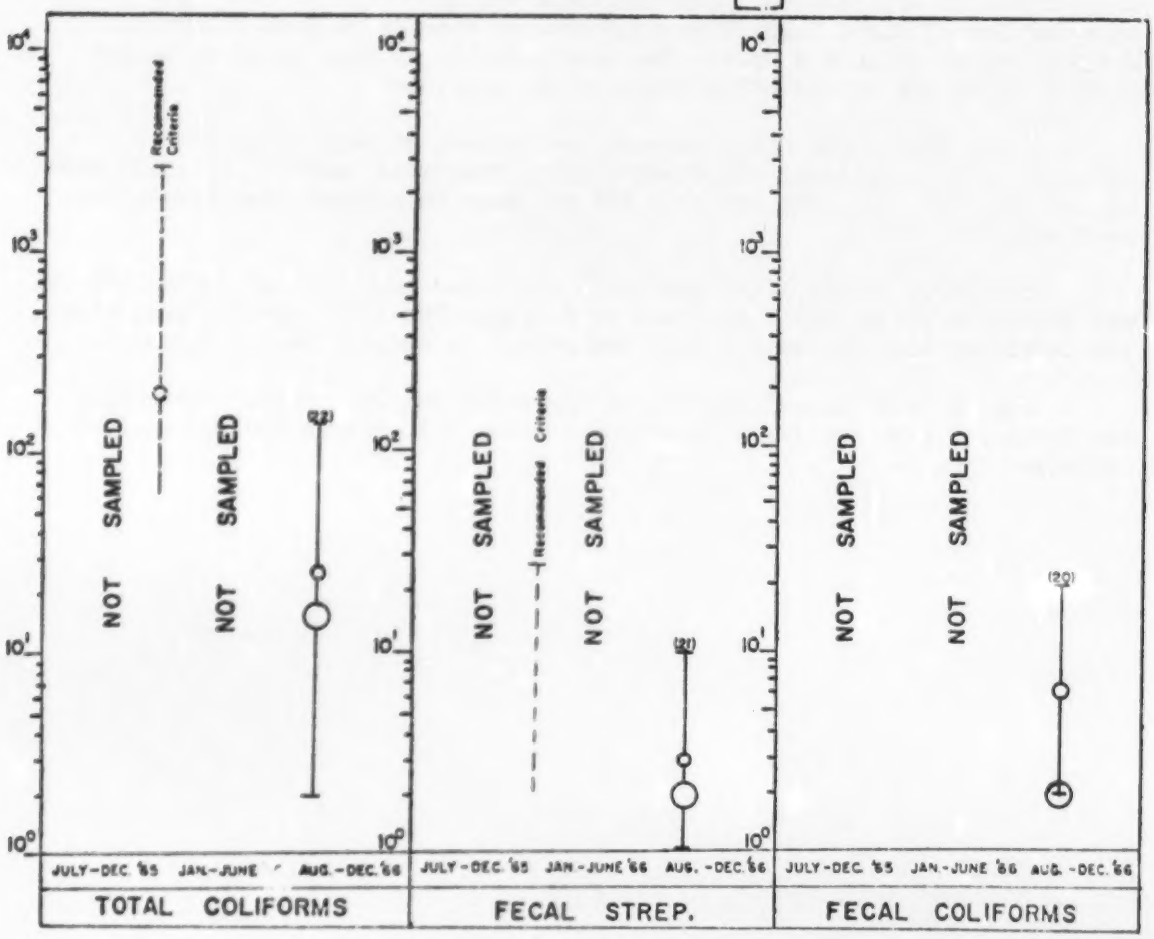
CALUMET AREA SURVEILLANCE PROJECT

MICROBIOLOGICAL WATER QUALITY

Station 17

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN
Great Lakes Region Chicago, Illinois





GPO 802-302-3

TABLE 17

CHEMICAL QUALITY OF WATER
STATION 17 - SOUTH DISTRICT DUNNE CRIB WATER FILTRATION INTAKE-LM 536.4

Parameter		Recommended Criteria Max	Min	Mean	Median	Aug. 1966-Dec. 1966 Max	Min	Mean	Median
Water Temp.	°C	29.4				23	3	14.7	15
pH		9.0	7.7		8.1-8.4	8.1	7.6	-	7.8
Conductivity	umho/cm	-	-	-	-	330	260	292	290
Alkalinity	mg/l	-	-	-	-	114	88	103	104
DO	"	-	80% sat.	90% sat.	-	16.30	6.05	12.17	13.20
BOD	"	-	-	-	-	1.6	0.2	0.91	1.0
COD	"	-	-	-	-	18	2.	9.6	8
Sulphates	"	50		23		32	13	22	23
Chlorides	"	15		8		12	8	9.3	9
MBAS	"	0.20		0.05		0.12	0.02	0.05	0.05
NH_3-N	"	0.05*		0.02*		0.23	0.01	0.07	0.05
(NO_2+NO_3-N)tot.N	"	0.4*				0.67	0.05	0.22	0.20
Org. N	"					0.33	0.02	0.19	0.20
Sol PO_4	"	-	-	-	-	0.06	0.01	0.03	0.03
Total PO_4	"	0.04*		0.03*		0.21	0.02	0.06	0.05
Iron	"	0.30		0.15		3.9	0.01	0.47	0.19
Cyanide	"	0.025				0.01	0.00	0.00	0.00
Sus. Solids	"	-	-	-	-	135	1	17.3	7
Dis. Solids	"	200		162		196	37	157	160
Fluorides	"	1.3		1.0		0.30	0.16	0.20	0.20
Oil & Grease	"	Free from floating oil				6.7	0.0	0.9	0.7
Phenol	ug/l	3.0*		1.0*		3	0	0.6	0
Turbidity	units	No contrast with natural appearance				160	0.6	13.0	2.7
Color	"	15		5		10	0	3.6	3
Threshold Odor	"	8		4		35	2.5	8.3	6

*tentative

Data based on 22 samples

BIOLOGICAL QUALITY

Biological field surveys have been made in the Calumet Area to assess any biological changes that may take place. Surveys were made during May 17-19, 1965 and during July 20-25, 1966.

The biological condition of the Calumet area was severely degraded. Pollution-intolerant organisms were not found at any location in 1966, whereas previously some did populate Mile Point LC 334.9 (Station 8) on the Little Calumet River.

The Calumet River from its confluence with the Grand Calumet River to the Calumet Harbor was severely degraded. Sludgeworms were the only organisms present. Calumet Harbor bottom sediments contained nail clams, but only a few were living. Sludgeworms were the only organisms found in the Grand Calumet River.

The bottom sediments of the Indiana Harbor Canal consisted of rock, rubble, petroleum wastes, and a black oily organic ooze. Sludgeworms were the only benthic fauna observed. Oil slicks covered the surface.

The attached table is a comparison of field observations. The first line of data for each station represents the 1965 data and the second line the 1966 data. The major differences in water conditions between the two surveys were temperature and pH. The benthic fauna were similar, with only the very pollution-tolerant organisms being found. The differences noticed could be attributed to the later season at which the samples were taken.

There was no significant improvement in water quality indicated by the biological field observations.

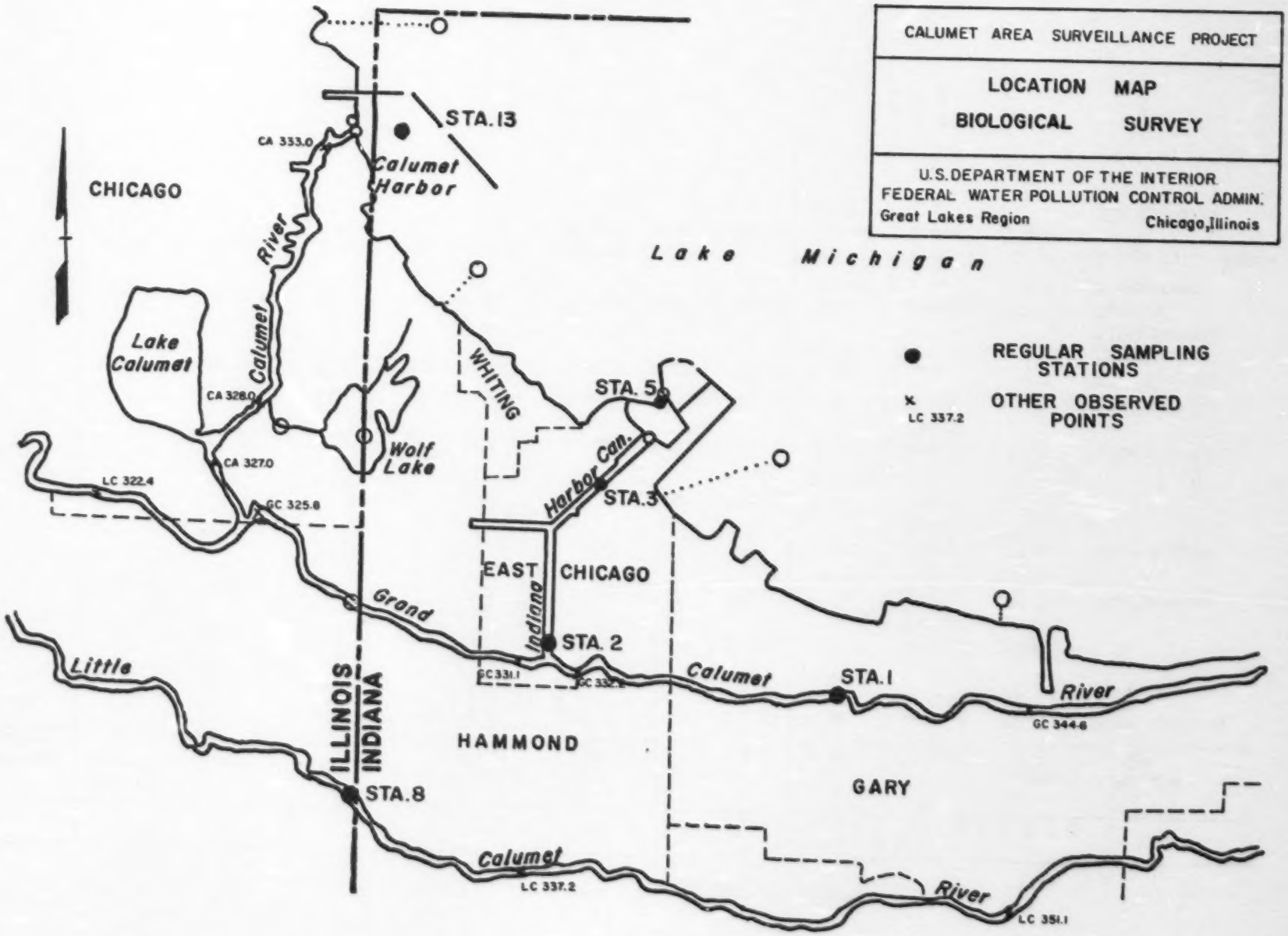

CALUMET AREA SURVEILLANCE PROJECT
LOCATION MAP
BIOLOGICAL SURVEY
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMIN.
Great Lakes Region
Chicago, Illinois
CHICAGO
STA. 13
CA 333.0
Calumet Harbor
Calumet River
Lake Michigan
Lake Calumet
CA 328.0
CA 327.0
Wolf Lake
WHITING
STA. 5
Harbor Can.
STA. 3
LC 322.4
GC 325.8
EAST CHICAGO
Indiana
Grand
STA. 2
Little
GC 331.1
Calumet
STA. 1
River
GC 344.6
ILLINOIS
INDIANA
HAMMOND
GARY
STA. 8
Calumet
LC 337.2
River
LC 351.1
REGULAR SAMPLING STATIONS
OTHER OBSERVED POINTS
LC 337.2

TABLE 18 - CALUMET AREA BIOLOGICAL SURVEY

Station Number	WATER								BOTTOM			
	Seechi Depth m	Temp. C°	D.O. mg/l	% Sat.	Depth M	Odor	pH	Time	Type	Odor	Temp. C°	Predom. Org.
1	.25	21.3	5.4	62	1.5	Petro	7.30	12:00	Ooze	Sewage	21.3	None noticed
	<.10	32	2.0	25	1.1	Petro	6.9	12:00	Silt	Petro	32	" "
									Sand			
2	.25	22	3.0	36	1.0	Sewage	7.05	13:15	Ooze	Sewage	22.0	" "
									Silt	Petro		
	<.25	32.0	1.6	21	2.0	Petro	7.0	13:05	Rock	Petro	32.0	Sludgeworms
									Gravel			
3	.3	21.5	3.0	34	7.0	Petro	8.65		Ooze	Sewage	21.5	None noticed
										Petro		
	1.5	31.0	3.5	45	9.0	Petro	6.9	11:15	Ooze	Petro	24.0	" "
									Silt			
5	.75	17.0	5.4	58	10.0	Sewage	8.0		Ooze	Sewage	17.0	Sludgeworms
						Petro				Petro		
	1.5	29.0	4.2	53	12.0	Normal	7.0	12:30	Clay	Normal		Sludgeworms
8	.2	19.0	8.8	100	.30	Sewage	8.20	15:00	Sand		19.0	Bloodworms
									Detri.			Mayflies
												Sludgeworms
	<.25	20.0	4.2	46	<.25	Sewage	7.6	10:50	Sand	Sewage	20	Snails
									Gravel			Bloodworms
13	2.5	16.0	8.9	93	10.5	Normal	8.2		Silt	Normal	13.0	Fingernail clams
	1.0	23.0	8.0	94	8.0	Normal	7.4	14:00	Gravel	Normal	22.0	" "
									Sand			Sludgeworms

ADDENDUM

REPORT ON CALUMET HARBOR MONITOR INSTALLATION

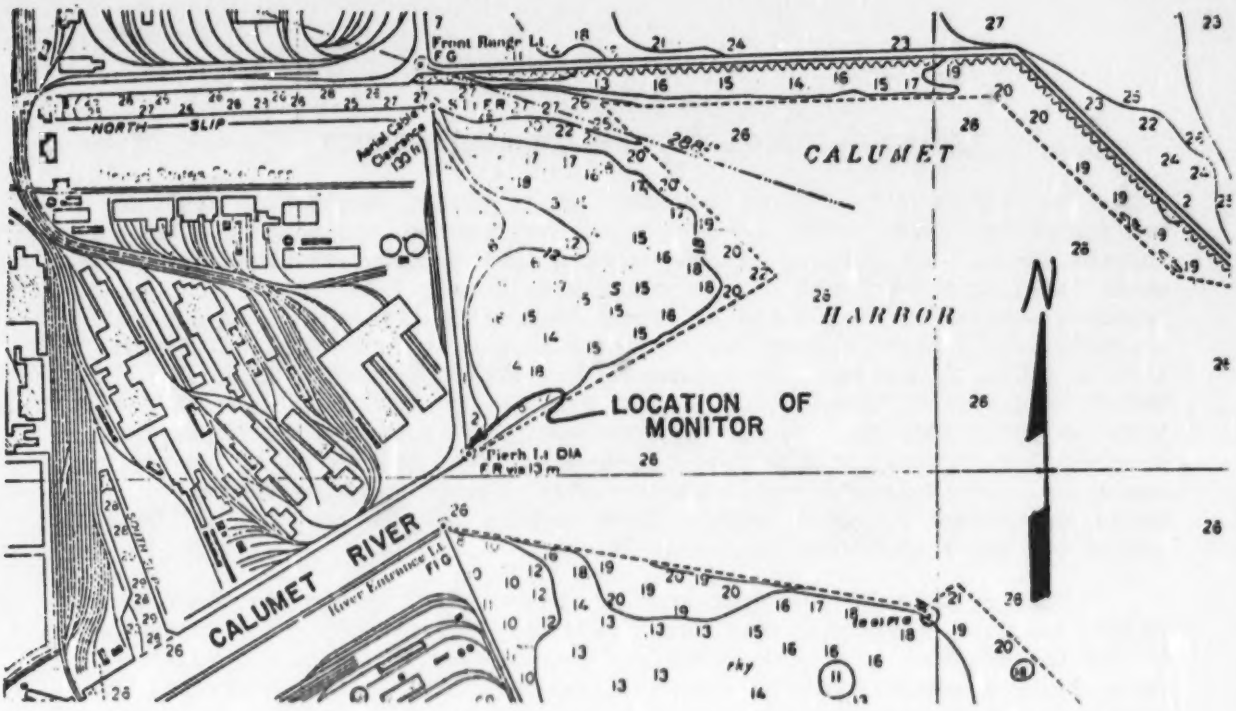
On September 2, 1966 an automatic water quality monitoring station was installed in the north pierhead light structure at the mouth of the Calumet River. The purpose of this station is to monitor the quality of water entering the Calumet River from Calumet Harbor. At present the parameters being monitored are pH, water temperature, dissolved oxygen and conductivity. In the future it is planned to monitor sulphates and ferric iron in order to determine more directly the effect of wastes from the United States Steel Corporation, South Works, which are discharged to the harbor. Parametric systems for these parameters, along with an automatic sample taker, are being developed and will be installed when they become available. The automatic water sampler will collect a sample when a parameter exceeds a preset limit. These samples will be returned to the laboratory for a more complete analysis.

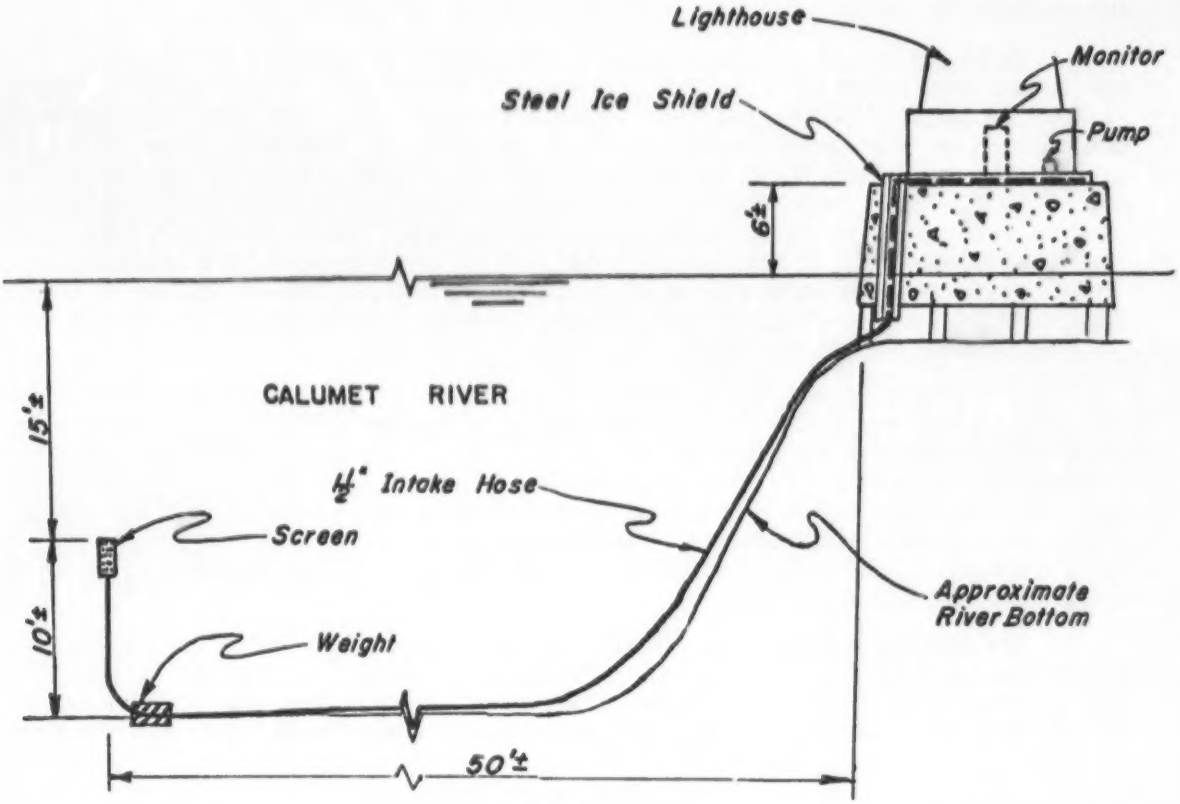
The installation and operation of this facility presented several unique problems. The only power available was 440 volt, 25 cycle furnished by the United States Steel Corporation. This was converted to 120 volt, 60 cycle by a motor generator set which was installed in the structure. The motor generator also provides heat which eliminates the need for a heater during the winter but overheats the structure during the summer. The summer temperature is controlled by a forced air fan operated by a thermostat set to turn the fan on when the inside temperature reaches 80°F. The fan entirely replaces the air every two minutes. This system has kept the ambient temperature within the range specified for operation of the monitor.

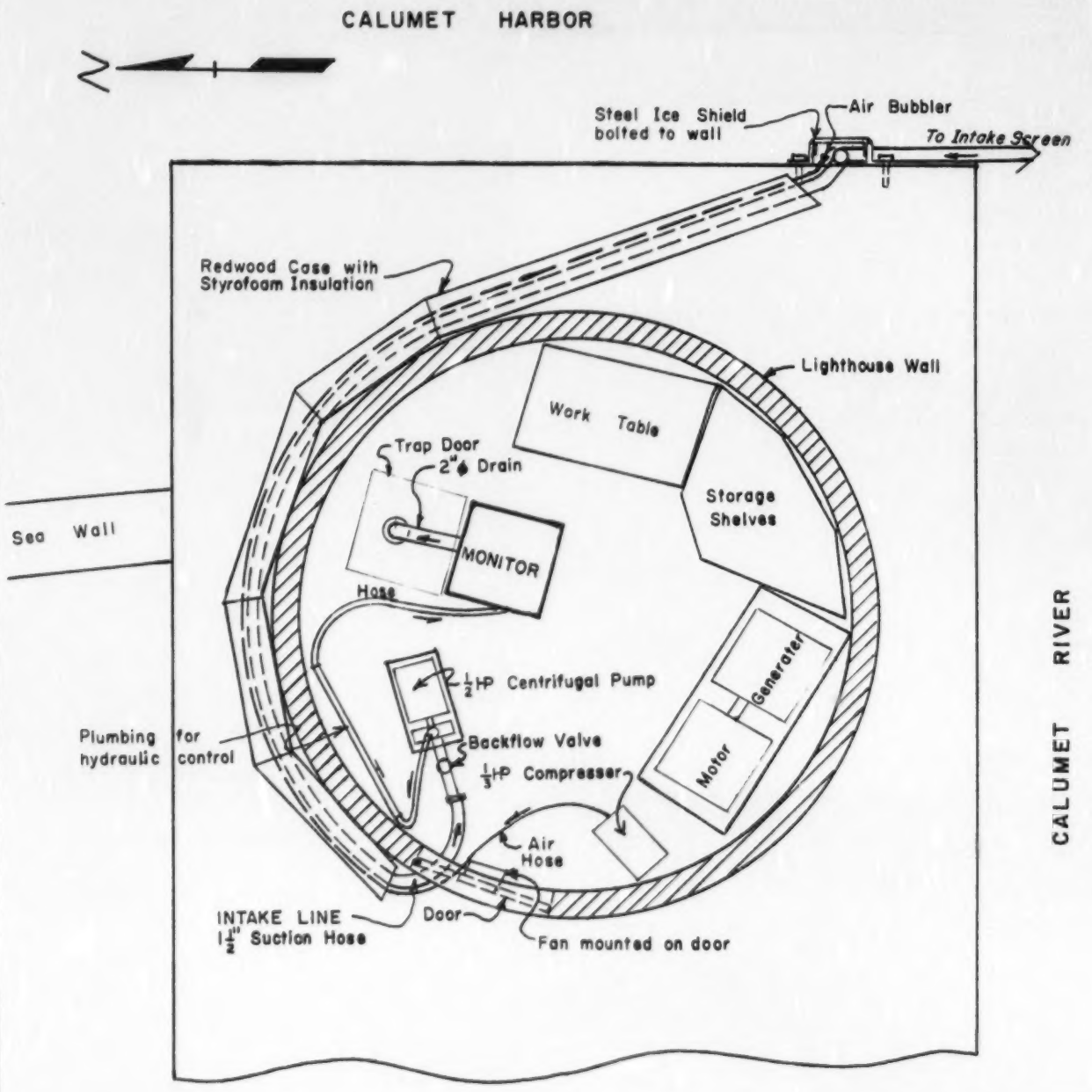
In order to get a representative sample it was necessary to locate the intake some distance out in the channel. The Calumet River at this point is heavily used by shipping of all types. It was recognized that any intake not located on the bottom would be struck by vessels. Since sampling on the bottom is not satisfactory, the normal submersible pump installation could not be used. The intake consists of a screen supported by floats on the end of a flexible hose which is anchored to the bottom. The floats keep the screen approximately 10 feet off the bottom and 15 feet below the surface. If a vessel hits the screen it will simply push it down and do little or no damage. The pump is a 1/2 HP centrifugal suction pump which is located in the structure with the monitor.

During the winter large piles of ice form against the side of the light structure along which the intake hose runs. In order to protect the hose a heavy steel member consisting of two 6" x 6" x 3/4" angles welded to a 10" channel was bolted to the wall and encloses the hose where it is exposed to the ice. In order to keep ice from forming inside the steel an air line with a 1/3 HP compressor continuously bubbles air inside the steel during the winter months. All exposed portions of the intake line are encased in redwood and insulated with styrofoam.

The monitor drains into a well located beneath the light structure. The discharge from the monitor was sufficient to cause the well to fill up and eventually flood the structure. Therefore, a sump pump was installed in the well which drains it when the water reaches a certain level.


NORTH SLIP
Aerial Cable Clearance 130 ft
CALUMET
HARBOR
N
LOCATION OF MONITOR
CALUMET RIVER
River Entrance Lt F10


Lighthouse
Monitor
Steel Ice Shield
Pump
6½
CALUMET RIVER
15'±
10'±
4½" Intake Hose
Screen
Weight
Approximate River Bottom
50'±



SCALE: 1" = 3'-0"

CALUMET AREA SURVEILLANCE PROJECT
PLAN OF CALUMET MONITOR INSTALLATION
U.S. DEPARTMENT OF THE INTERIOR. FEDERAL WATER POLLUTION CONTROL ADMIN. Great Lakes Region Chicago, Illinois

GPO 802-302-2

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